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To 600 dpi:
4 Hi-Res
Controllers**

AFTER HOURS

**Make Great Posters,
Flyers, and Banners
With The New
Print Shop**

HARDWARE

**12 Data Projectors
For Bigger, Better
Boardroom
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FREE UTILITY

**Variable-Speed
Cursor Control:
TYPEFAST Revs
Up Your Keyboard**

MAGAZINE

APRIL 24, 1990

THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

VOLUME 9 NUMBER 8

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- 🔴 SmartWare II
- 🔴 Twin Level III



Word
processing will
evolve more
in the next three
pages than it
has in the last
ten years.

Market Survey and Ten-Year Growth Plan

EXECUTIVE SUMMARY

BLUE YONDER AIRWAY



Introduction

As Blue Yonder Airways moves from freight to passenger service, the Sales and Marketing Division is presented with a multitude of new challenges and opportunities. This report consists of a marketing proposal for the next ten years -- a virtual blueprint for growth in our critical first decade as a passenger carrier. Our

resulting from a series of focus groups conducted by the market research firm Crump & Graham. The growth plan includes specific suggestions for ways to leverage our track record in the freight arena to build out our share of single-passenger bookings, and ultimately expand into general sales. A detailed analysis of costs and

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could you want?**



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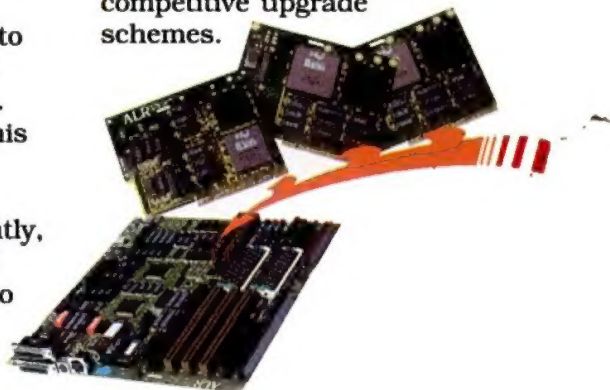
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CIRCLE 185 ON READER SERVICE CARD

Inside

The news in this issue is spreadsheets—our first full roundup since 1987. The period since then has been full of exciting news, from the long-awaited introduction of *Lotus 1-2-3*, Release 3.0, to the emergence of the first OS/2 spreadsheets from Lotus and Microsoft. *PC Magazine* has worked to keep you on top of these events as they happen, with detailed articles on Release 3.0 in the November 28, 1989, issue and on *Microsoft Excel* in the February 27, 1990, issue. And we'll continue to do so, notably for *1-2-3/G*, which should be hitting the streets about the time you read this. In the meantime, here's your chance to see how today's spreadsheets stack up against one another.

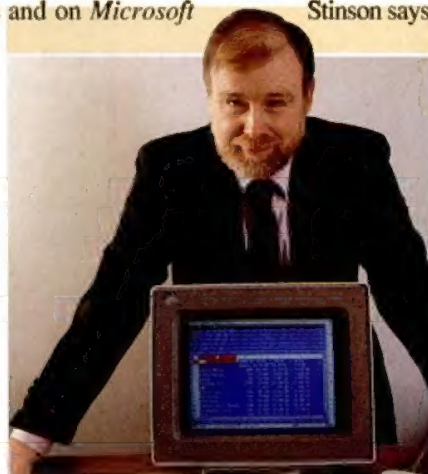
It's clear that we've grown into a more complex world, and its realities figure prominently in our new testing script. For the first time in this category, we've supplemented our usual tests with suitability-to-task ratings on three-dimensional work, graphing, and worksheet publishing, as well as on ordinary spreadsheet tasks. And in deference to today's interconnected, multiplatform world, there's also a rating for interoperability. Our changes reach into the performance tests as well; you'll find a new link-refresh test alongside our traditional performance tests.

To pull it all together, we chose



Craig Stinson, a longtime spreadsheet maven and, not coincidentally, the new editor of our Spreadsheets column. Though he began his career as a music critic, Stinson gravitated toward personal computers in their early days; he first became acquainted with an innovative program called *VisiCalc* while writing for a now-disappeared computer magazine, *Softalk*.

Stinson says he plans to broaden



Stinson keeps his finger on the pulse of the spreadsheet market from his home and office in Arcadia, California, near Los Angeles.

the range of products that appear in the Spreadsheets column, as well as leaven it with lengthier pieces on technically interesting issues and products. Stinson worked closely with PC Labs' project leader Wendy Dugas Pérez and associate editor Ed Perratore to shape the story,

as well as to update and improve our spreadsheet testing procedures.

Once you've massaged those numbers, you'll want to find a way to present them. This issue also brings you a second installment on tools for large-scale presentations, in which we review 12 data projectors. And for printed output, check out our mini-feature on high-resolution printer controllers for your Hewlett-Packard LaserJet II. For prices ranging from \$1,700 to \$3,000, these controllers can double or quadruple your text resolution, giving real snap to those small fonts.

—Rock Miller

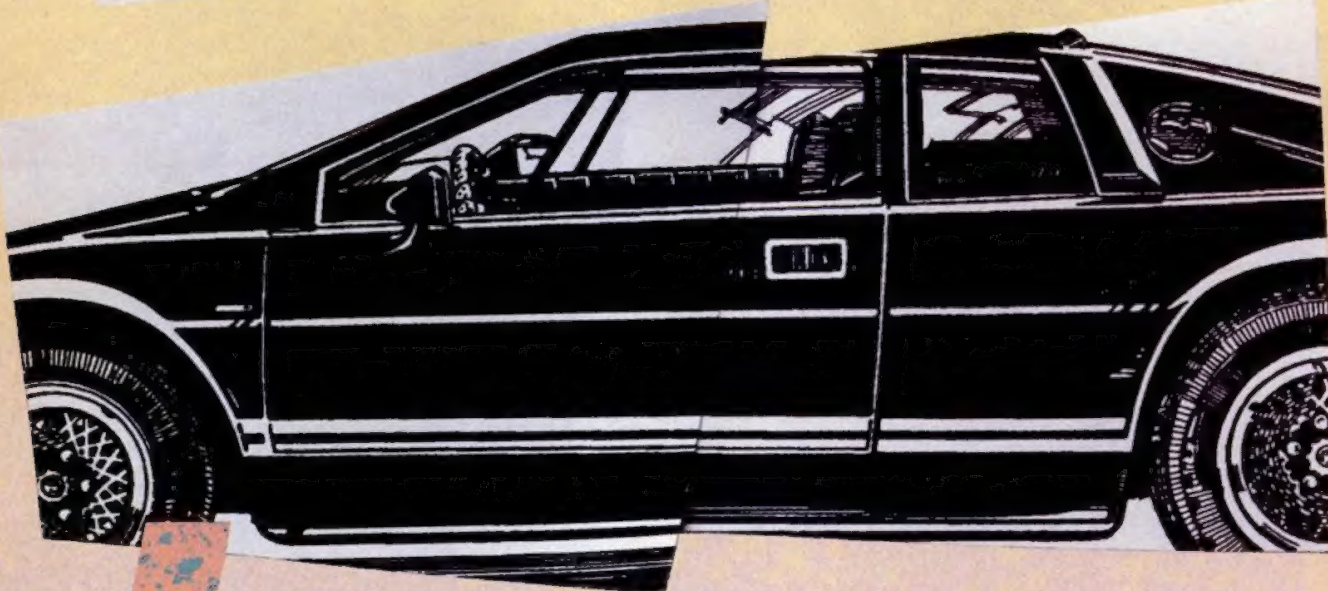
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—Publish!
November 1988



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Taxan Ultra Vision 1150 monitor offers a large workspace and high resolutions to CAD, DTP, and graphics users.

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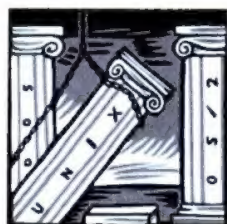
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Spreadsheet Heavyweights Take on 1-2-3

Craig Stinson/ Lotus 1-2-3 is still the first choice for a majority of spreadsheet buyers. But how do its top contenders compare? To find out, PC Labs tests 12 high-end spreadsheets with file-linking capabilities, including Quattro Pro and the OS/2 versions of Excel and 1-2-3 3.0.



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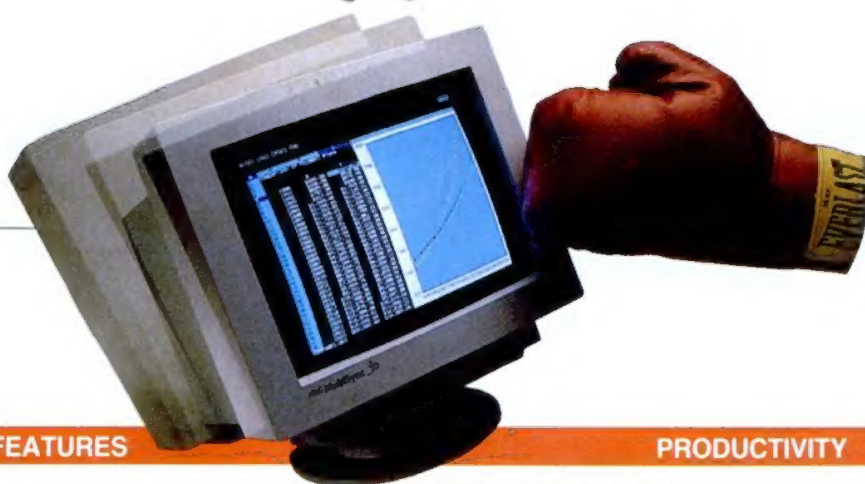
Looking Great for Less

Edward Mendelson and Robin Raskin/ Contributing editors Edward Mendelson and Robin Raskin test four add-in boards for the HP LaserJet II that boost its text resolution to 600 dots per inch or even higher. Each can be purchased for less than \$3,000, making a package that's well under the cost of a 600-dpi printer.

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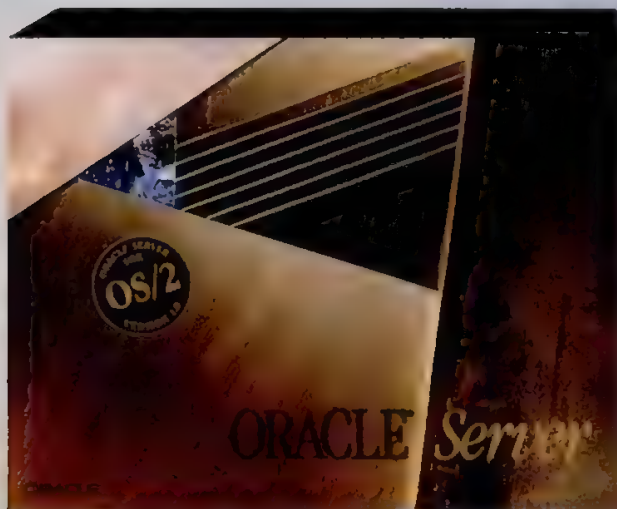
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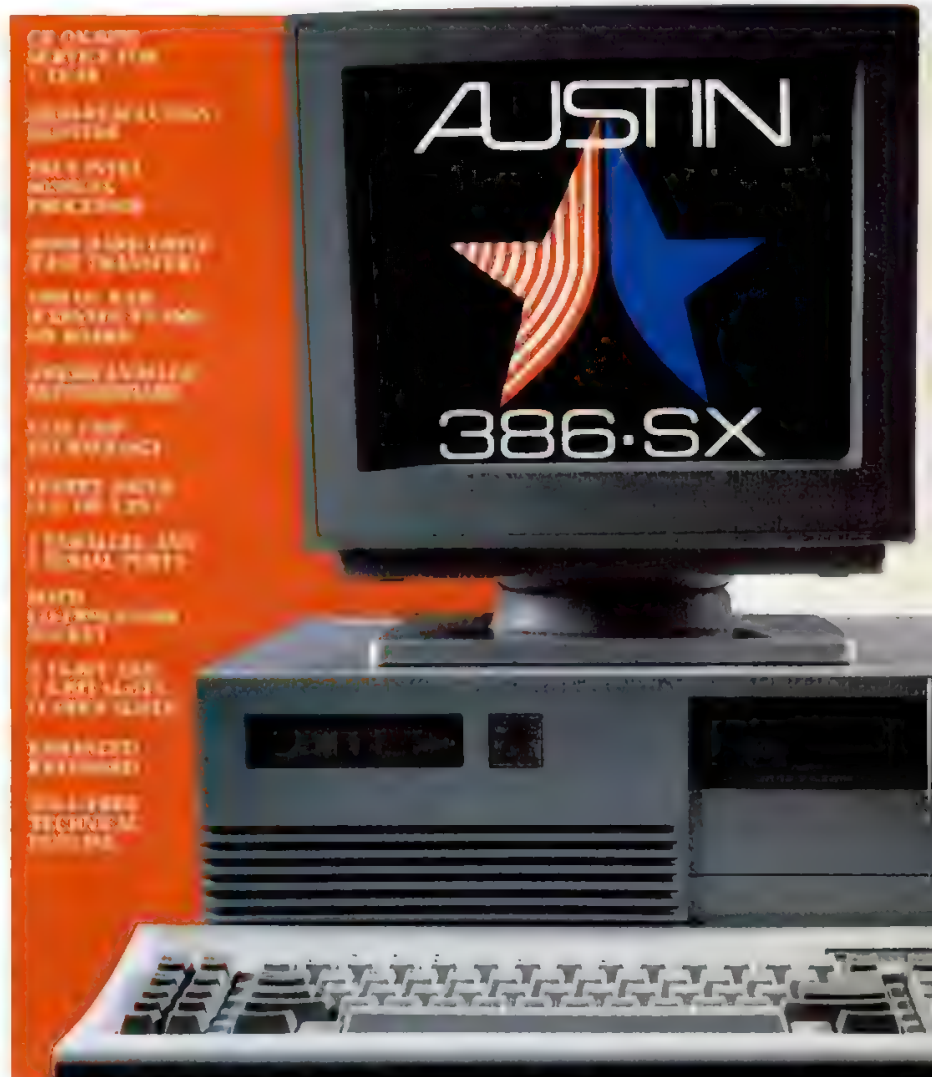
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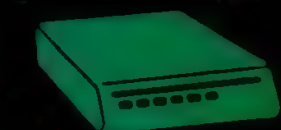
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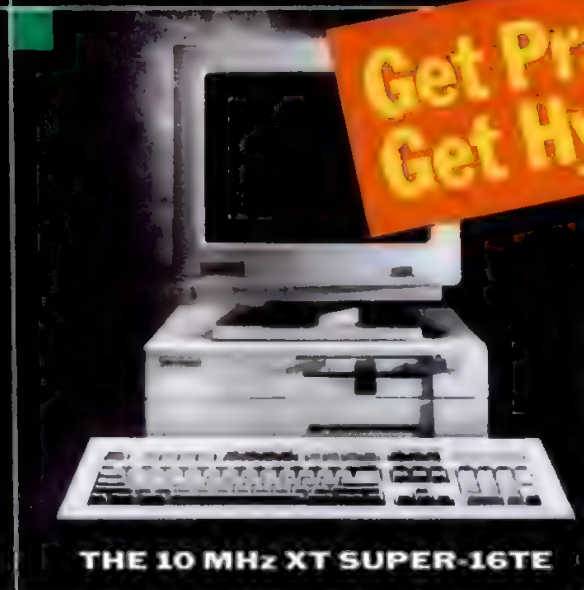
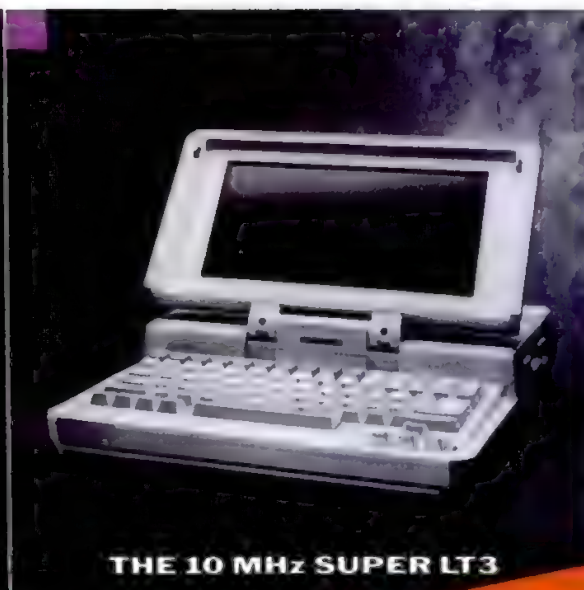
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Letters

SECRET OF MY SX

Your feature on 386SX computers ("386SX: The New Corporate Standard," *PC Magazine*, January 30, 1990), made some good points in its argument that these are the ideal entry-level PCs. I agree that there is very little reason to buy a 286 machine, given the superior performance of the SX and the small price difference between the two tiers of machines.

However, doesn't a similar argument apply when one considers the 386 vs. the 386SX? If I were buying a new machine today, I would have to go not with the SX, but with the full-blown 386.

Where the SX chip offers its greatest potential is as an upgrade CPU for the millions of 8088 and 8086 machines already in place. I bought a SOTA 16-MHz 386SX card for my 8086. It took all of a half hour to install. The card, which has a 16K cache on it, drops down to native 8086 speed with a keyboard press. But I've never had to do this; every package I use runs perfectly.

For \$450 I have a perfect cure for my Model 30.

Stephen K. Holzinger
Merrick, New York

While we appreciate the inclusion of our machine, the Tatung TCS-8800S, in the roundup of 31 SX-based computers that appeared in the January 30, 1990, issue of *PC Magazine*, your conclusion that "right now the TCS-8800S is hard to recommend" is based on incorrect price information.

On page 170, the review states: "At a cost of \$4,595, the test system is one of the most expensive machines reviewed here. . . ." While true, this statement overlooks the fact that if our competitors had supplied similarly configured test units, their prices would have been comparable.

Furthermore, the price for the basic system with no hard disk or monitor is \$1,995, not \$2,895, as listed in the prod-



uct's fact file. And contrary to what was reported in the features table, the standard configuration, which adds a 40MB hard disk and a VGA monitor and card, is \$2,895, not \$1,995.

PC Magazine's reviews are the benchmarks against which products are measured in this market. Because of your integrity and reliability, your reviews can make or break a product. We're not asking for a favorable review—just one based on facts.

Michael A. Simek
National Sales Manager
Tatung Company of America Inc.
Long Beach, California

PC *PC Magazine* regrets the error in pricing for the Tatung TCS-8800S. The \$4,595 tested system was configured with 8MB RAM, a 106MB ESDI hard disk, and VGA. Based on *PC Magazine's* standard 1MB RAM, 40MB hard disk, VGA configuration, the \$2,895 Tatung compares favorably in price with the 30 other SX machines, especially when dealer discounts are taken into account.—Ed.

ALLWAYS A WINNER

The choice of Funk Software's *Allways* as one of 1989's best programs ("The Best of 1989," *PC Magazine*, January 16, 1990) is certainly deserved. Just about all of our 1-2-3 users have access to a laser printer, and every one of them has forgotten how to print from within 1-2-3 itself. This is precisely the reason why it is so frustrating that Lotus didn't incorporate *Allways*-like printing technology into 1-2-3, Release 3.

I can hardly wait until *Allways* for Release 3 comes out. This has got to qualify as the most anticipated product upgrade of 1990. Until this package comes out, we will quietly curse Lotus every time we have to switch back to Release 2.01 just to print our spreadsheets.

Brian W. Jennings
Albuquerque, New Mexico

CASE CLOSED

We appreciate the review of our product, *Analyst/Designer Toolkit*, in the January 30, 1990, feature on CASE tools. Unfortunately, the review and associated sidebars gave an incomplete picture of our products and of the field itself.

The review opens with a tribute to Ed Yourdon, our founder, and to Yourdon Press, a subsidiary of Prentice Hall. It should be noted that Yourdon Inc. is a wholly owned subsidiary of Eastman Kodak and is not affiliated with Yourdon Press. Ed Yourdon is an independent consultant, providing services to Yourdon Inc.

What should also be noted—and was omitted from the article—is the fact that CASE tools are but one part of a total solution for improving the process of systems development and the resulting products. Buying a CASE product, therefore, will not improve your productivity and quality without a commitment to the underlying methods and techniques the tool automates. With the exception of *IEW*, all of the products evaluated in the article attempt to automate parts of the method that Yourdon Inc. developed.

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Letters

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Adrian J. Bowles

Vice President

Yourdon Inc.

Raleigh, North Carolina



COMPUTERS AND THE HANDICAPPED

I enjoyed Bill Machrone's column on PCs and the handicapped in the January 30, 1990, issue of *PC Magazine*. However, limiting the discussion to the workplace environment ignores the many handicapped people unable to be employed but still needing a level of independence and communication available only through modern technology. Should we limit the availability of these devices to just those people who can turn a profit? Or should we try to supply them to individuals who want to converse with their children?

Machrone's column displayed a sympathy for the disabled, and obviously he knows of many more issues than could be explored in one page of text. I hope that *PC Magazine* will keep this subject alive in its pages, helping those of us who try to help others.

Guy R. Winters

Andover, Minnesota

Thank you for the sidebar, "The Key to Enabling the Disabled" (see "Oddball Keyboards," *PC Magazine*, December 12, 1989, page 266). Computers can do so much to enhance the lives of people with limited ability to communicate or control their environment. It's nice to see this application of technology acknowledged in *PC Magazine*.

I was somewhat disappointed, however, that there was no mention of our product, the *Eyegaze System*. Hosted on a PC, this is a sophisticated communications and control system for the disabled. *Eyegaze* allows an individual to run DOS applications using eye movement alone. With experience, speeds of up to 20 words per minute can be achieved before adding keyboard macros and other accelerators.

Peter L. Norloff

LC Technologies Inc.

Fairfax, Virginia



STICKING UP FOR DVORAK

In the January 30, 1990, issue, you printed several letters bashing John C. Dvorak. Now I'd like to state the case for the pro-Dvorak faction of your readership.

Sure, the man has a mouth on him, there's no doubt about it. And sure, he often irritates me, and often I disagree

**Computers can do so
much to enhance the
lives of people with
limited ability to com-
municate or control
their environment.**

with him. But Dvorak's column is the first to which I turn, and I would bet I'm not the only one. It is chatty, irreverent, and almost always interesting.

If people don't like Dvorak, let them read the other 350-plus pages of the magazine. For my taste, keep him in there, he shakes people up.

But do us all a favor and ditch the randomly boldfaced type, huh, John?

Ronald E. Jeffries

Pinckney, Michigan

In the past four years that I've been reading *PC Magazine*, I've had ample opportunity to agree and disagree with John C. Dvorak. I've also had ample opportunity to smile, laugh, and get angry at the man.

In the January 16, 1990, letters column, reader Robert McAdams complains about an earlier Dvorak column (John C. Dvorak, *PC Magazine*, September 26, 1989), in which John suggests that multitasking is best performed by two separate machines. Well, as an owner of a 16-MHz 386 running QuarterDeck's *DESQview*, I must agree—albeit unhappily—with Dvorak.

When you multitask—and I have yet to do some serious work with OS/2—you ask for trouble. More often than not, applications will not switch cleanly. On a number of occasions, I have managed to bring *DESQview*—which happens to be an

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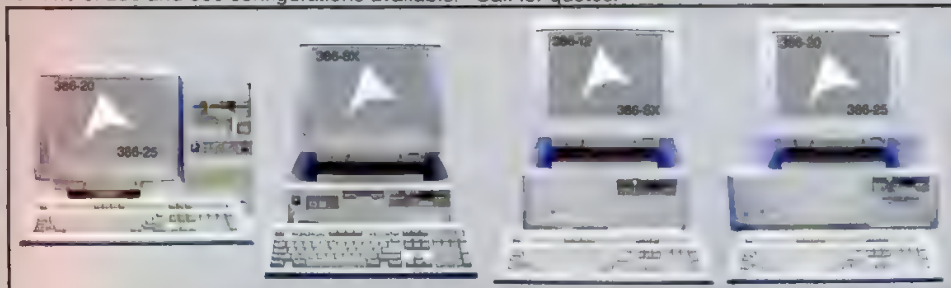
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Come on guys! Not all your mail on Dvorak can be bad. Publish the positive, too.

four sessions: DOS, *WordPerfect 5.0*, *XtreePro*, and *ProComm Plus*—not a heavy load by any standard. Now I have my 386 and a 3Com 3Station on my desk. No more multitasking here.

John, don't let them get you down.

Harry Cederbaum
Forest Hills, New York

Come on guys! Not all your mail on Dvorak can be bad. Publish the positive, too.

John's my favorite columnist. Sure, he doesn't always play fair. But what big league pitcher does? He roughs up the ball, spits on it even, and puts a spin on his ideas as he pushes 'em across the plate.

Send his detractors to Arkansas to code COBOL with Ben Sabia (Letters, *PC Magazine*, January 30, 1990). John is every editor's dream. Even the people who hate him read him—which just proves they don't have any sense.

You and John keep on pitching.
D.C. Stultz
Melbourne, Florida

ON THE OTHER HAND...

Because of John C. Dvorak's incessant bashing of Microsoft, I have decided to join the ever-growing throng of Dvorak bashers.

An objective, insightful, or even biased review of the myriad products in the market might be enjoyable. I do take exception, however, to Dvorak's constant maligning of Microsoft. I hold no specific allegiance to any company. I evaluate each product's merits individually, and I believe

Mr. Dvorak should do the same.

If his hatred of Microsoft impedes any hope of objectivity, he should refrain from mentioning or reviewing their products. He may then concern himself with the rest of the market.

Glenn Gibbs
Boiling Springs, South Carolina

FOR WHOM THE LAN TOLLS

Jim Seymour, in his January 30, 1990, column is right: LAN administration is the worst job in America.

I manage only a small network. Two file servers, 40 workstations, 30 printers, all good equipment—Compaq, IBM, Hewlett-Packard, Epson. Just a few, simple (ha!) applications.

I used to be mentally and physically healthy, a marathon runner, a well-balanced social individual, a kind person. Now it's a pack a day, regular therapy sessions, and when I'm able to sleep, I curl up in a corner behind the refrigerator where it's warm.

Bob Kulpa
Miami, Florida

SLICK CODE

Just want to say "great job" to *PC Magazine*, and especially to Terry Lahman, for PCREMOTE (Utilities, *PC Magazine*, January 16, 1990). This program simplified a number of my chores where a little bit of memory meant a lot. It isn't quite the commercial product that *pcAnywhere* is, but it gave me the desire to finally join PC MagNet.

John F. Jarrett
Show Low, Arizona

PCREMOTE is the slickest thing I've yet to see and I want to give a pat on the back to Terry Lahman. This program works as effectively as *pcAnywhere*. As is the case with all your utilities, my annual subscription has just paid for itself several times over. Great job, folks!

Gerry Massie
Chesapeake, Virginia

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by Lori Grunin

Advisor

BEFORE YOU FLIP THE BIG RED SWITCH

I have a question that many computer users probably have had at one time, but never asked: How do I know that what I got is what I bought?

I am planning on buying a computer through the mail. When I get the system, which will have cost me around \$5,000, how can I make sure that the mail-order house sent me everything that I paid for? How can I make sure that all the "extras" that I ordered are the ones I really got—for instance, that the memory chips rated at 90 nanoseconds are really not 100-ns chips and that the hard disk is running at 19 milliseconds and not at 23 ms?

Michael J. Mitchell
Mishiwaka, Indiana



I don't think that part substitution is as big a problem in mail order as is part failure and adequate post-purchase support. It is, however, an excellent idea to familiarize yourself with your system when you first receive it—and reassure yourself that it's appropriately configured—instead of waiting until you want to install a peripheral or need to replace a part. Also, a thorough going-over before you begin using the system can help you avoid some hair pulling when you're trying to set it up.

Before you start plugging things in, take the CPU out of the packing material and set it on a flat surface. Is it stable, or does it rock back and forth? If it rocks, a rubber foot might have fallen off during shipment: check the box the CPU came in. Take a look at the case and make sure it fits properly over the chassis: are the drives firmly in place or are they crooked? They may have jarred loose during shipping. Also, if the computer is for home use, look at the back of the unit for an FCC Class B certification sticker.

Next, remove the cover from the CPU, following the manual's instructions.

Look at the cards in the expansion slots. Are they screwed in and firmly

■ **BEFORE YOU FLIP THE BIG RED SWITCH:**
Taking inventory of your new system before you start computing.

seated in the slots? Are any of the cards obstructing an empty slot? Do you have the proper number of serial and parallel ports? A one parallel/one serial port combination usually comes on a single 8-bit card containing a 9-pin serial and a 25-pin parallel connector.

Then look at the video adapter. If you feel comfortable doing so (and have done it before), ground yourself, unscrew the card, and remove it. Otherwise, grab a flashlight and try to examine the card without removing it. Look at the output port and make sure that it's the correct type of display adapter: VGA uses a three-row 15-pin connector; EGA and lesser resolutions, a two-row 9-pin one. The manufacturer's name should be on the board, although sometimes it's hidden beneath a sticker with the reseller's name on it. Is it the brand you wanted? Look at the graphics controller chip—usually the biggest chip on the card—and write down the ID information for future reference.

Are there any jumpers or DIP switches on the card? (A jumper usually looks like a black piece of plastic-covered metal with holes in it and slides over pins to complete a circuit.) The jumpers and switches determine the IRQ and addresses used by a card, so make a note of the adapter's current settings. (Sometimes the DIP switches are on the metal bracket that faces out of the back of the machine.) Now is a good time to pull out the manual for the adapter and see what the settings mean. Jot down the information; it will save you some heartache when you start installing more boards.

Lastly, look at the chips on the card. If you bought a card with 512K of VRAM, make sure that you got a card with 512K (for instructions on reading chip IDs, see "Memories" in the Advisor column of the January 30, 1990, issue of *PC Magazine*). Replace the adapter, making sure that the connector is firmly seated in the expansion slot.

Repeat the process for the other cards, but *don't remove the drive controller* (usually the card closest to the drives and power supply, with several connectors plugged into it). Although you won't get struck by a lightning bolt if you do remove it, you have to be careful about reattaching all those connectors properly, which you really don't want to have to deal with at this point. Do try to identify the controller manufacturer, however, and read any information about the controller that accompanies the system. Low-level disk utilities can be picky about controller types, so it's good to know the make and model number.

Now go back to the motherboard. Do you see any wires running across it? If so, feel free to call technical support for an explanation. The machine will probably operate without problems, but a patched hardware modification may be the culprit in some future difficulty.

Although much of the motherboard is exposed, some of the chips you're looking for may be located beneath the drive bays. It's difficult, but you can probably read the information on the chips with a flashlight and some upper-body contortions.

First locate the CPU, which should be a chip approximately 1.5 inches square, and read the ID. Embedded in the ID are the processor type (such as "80386DX" or "80386SX") and the speed (such as "-33" for 33 MHz). The math coprocessor, if you ordered one, looks the same and is labeled similarly.

If you can't find the CPU but instead see an appropriately sized square covered with what looks like a small black magazine rack sitting in the middle of the

Advisor

motherboard, ring the warning bell. That black cover is called a *heat sink* and is used to keep chips that are pushed past their rated speed from overheating. Unless you specifically ordered such a "pushed" machine, call the company and find out what the story is.

The BIOS usually consists of a large (about 1.5 to 2 inches long) rectangular package in sets of one, two, or four chips. A sticker on the top will give the manufacturer, copyright date, and sometimes a revision number; make a note of this information. Occasionally this same information is displayed during boot-up. Most clone BIOSs are made by AMI, Phoenix, and Award.

Lastly, check out the memory chips (see the aforementioned "Memories" to examine these). Note the size (such as 4 by 256K), amount, type (for example, SIMM versus DIP packaging), and the speeds of your main memory and cache memory (if there is a cache).

Put the system back together and con-

nect all the pieces according to the instructions in the manual.

When you boot the machine, see how much memory the memory check reveals. If you ordered 1MB of memory and found 1MB on the motherboard when you inspected it but the memory check shows less than 1MB, the system may be using

If you ordered a 150MB drive, you should have at least 150MB of usable disk space.

some of that memory to shadow the system and video BIOSs. For future reference, it's a good practice to make certain that your idea of 1MB and the reseller's idea of 1MB coincide before you order the system.

Once you're up and running, run CHKDSK or install a disk utility such as

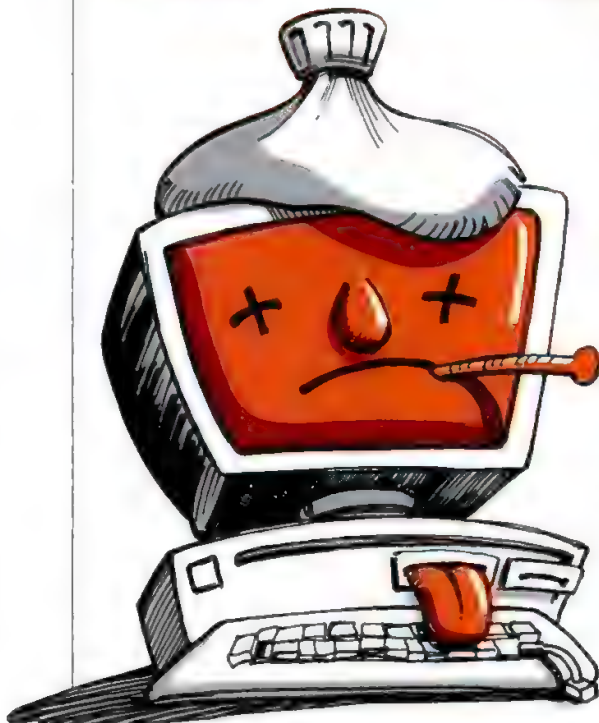
The Norton Utilities (\$100 for the *Standard Edition*, \$150 for the *Advanced Edition*; Peter Norton Computing, 100 Wilshire Blvd., 9th floor, Santa Monica, CA 90401; (213) 319-2010. Reviews of these utilities appear in the March 27, 1990, issue of *PC Magazine*). Use it to see how many sectors were marked bad on your hard disk before it reached your desk. Although a small percentage of bad sectors is normal, if you ordered a 150MB drive, you should have at least 150MB of usable disk space (including space devoted to any software already installed).

Keep the machine running continuously for the first week or so that you have it (or longer, if you desire). If any parts are going to fail, chances are they'll do so during your break-in period. In general, the parts elected "most likely to fail" are the drives.

ASK THE ADVISOR

Send your questions to Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column for access information). Please specify your equipment. ■

What's Wrong With This Computer?



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- ☐ Communication Port Bug?

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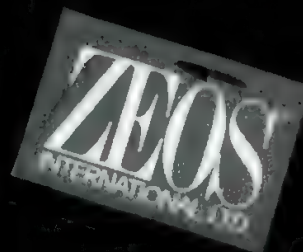
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PC Magazine, May 30, 1989

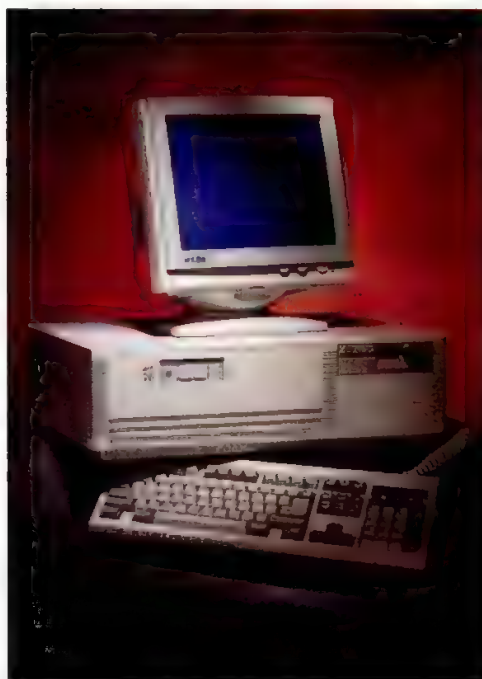
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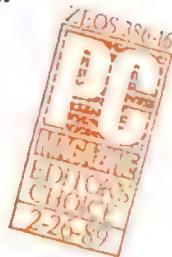
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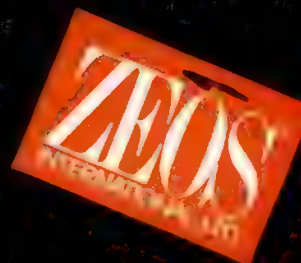
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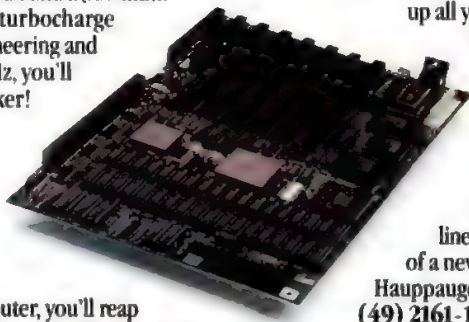
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CIRCLE 276 ON READER SERVICE CARD

First Looks

Hands-On Reviews of the Latest Products

Dolch Unveils First 486 Lunchbox-size PC

HANDS ON
by Matt Rice

Dolch Computer Systems has made a name for itself by making the fastest portables, and the company goes so far as to include a photo of a Lamborghini Countach on the cover of its documentation. With the release of the P.A.C. 486-25—the vanguard of portable 486 computing—Dolch continues this tradition.

But Dolch does not live by speed alone. The \$12,995 Dolch P.A.C. 486-25's numerous options provide enough expansion possibilities to satisfy any power user, all in a 20-pound lunchbox.

At the heart of this desktop replacement is the 80486 processor, complete with its internal 8K cache and math coprocessor. But Dolch did not stop there. For those of you who crave power, the P.A.C. 486-25 also supports Weitek's new 4167 coprocessor, to provide even faster number crunching. Dolch has a limited quantity of Weitek chips, but with a list price of \$3,795 and the Dolch P.A.C. 486-25's own processing power, the demand should not prove overwhelming.

The system board is a joint effort between Dolch and Advanced Integrated Research and is manufactured in California. Indeed many of the components are built in the U.S., including the memory board and power supply.

The P.A.C. 486-25 has six accessible full-length industry-standard architecture slots, with two 16-bit slots and one 8-bit

CONTINUES ON PAGE 34



Blazing speed, 486 power, and economy of design are the hallmarks of Dolch's 20-lb. P.A.C. 486-25.

HANDS ON
by Richard Hale Shaw

Quadbase-SQL, a \$795 development environment for writing relational database applications using embedded SQL and C, lets *dBASE* programmers cast off the shackles of pseudocompilers and lets C programmers harness the power of SQL.

Because *Quadbase-SQL* uses *dBASE III Plus* data files and indexes, your applications can leverage existing data and be instantly compatible with other programs. However, *Quadbase-SQL*'s embedded SQL prevents an application from being straight-jacketed by *dBASE*'s pseudorelational data

model. Instead, an application can rely on SQL's real relational data definition and data manipulation capabilities to handle its database concerns.

By now, the benefits of relational databases and SQL should be familiar: the relational model hides the underlying storage system from an application, making a database appear as a collection of tables, rows, and columns. SQL provides a high-level means of implementing relational operations that query, retrieve, update, and create tables. Even the results of SQL queries are tables. And since SQL only provides data definition and data manipulation facilities, it's a natural

when embedded in a powerful application development language like C.

Quadbase-SQL does this the old-fashioned way, like IBM's mainframe DBMS, *DB2*. You create an .EC file, which is your C program with SQL statements embedded in it. (Each SQL statement is preceded by "EXEC SQL" in the source code, and C field variables are easily wedded to SQL table structure elements.) The embedded SQL preprocessor converts these into C functions that call *Quadbase*'s relational database engine (RDE), and produces a .C file, which you can compile with Microsoft C. Link

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Quadbase-SQL Brings Real Relational Power to dBASE and C

First Looks

Dolch 486

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slot available after the memory, I/O, and video cards. The system board actually contains eight slots, but like most lunchboxes, fitting everything into the 10- by 15.75- by 8.25-inch (HWD) case proves difficult. But Dolch does a good job of making things fit, as demonstrated by the 200-watt power supply that covers only two expansion slots.

The Dolch P.A.C. 486-25's expansion slots are full length. A small cooling fan is positioned at the opposite end of the expansion slots, circulating fresh air across not only the expansion boards, but the 486 and Weitek processors as well.

Residing in the first slot is Dolch's memory board, a prime example of the P.A.C. 486-25's expandability. The standard system ships with 2MB of 70-nanosecond RAM using SIMM packaging. This design offers easy expansion up to a system total of 16MB using standard 1MB modules.

One drawback of the memory board design is the height of the SIMMs. Our evaluation unit shipped with 4MB of system memory filling 4 of the 16 sockets. These modules hang into the empty space of the 8-bit slot next to the memory card. The memory modules will impinge on many standard expansion cards, shrinking the number of available slots down to two 16-bit slots.

An 8-bit Chicony CH-101B I/O adapter provides one serial and one parallel port, as well as an integrated floppy and IDE

hard disk controller. Dolch offers either a 1.2MB 5.25-inch floppy disk drive or the 1.44MB 3.5-inch drive that came with the tested unit. The standard hard disk is a 100MB Conner Peripherals drive that performed adequately on the PC Labs benchmark tests, but not up to the high speeds of the processor and memory. A 200MB Conner unit is also available, or with the available slots you can choose to install a caching hard disk controller and faster ESDI or SCSI drive.

An 8-bit Paradise PVGA adapter drives the Dolch P.A.C. 486-25's very legible gas plasma display, a \$595 option over the standard double-scan CGA electroluminescent display. The plasma display hooks up to the video board's feature connector, providing simultaneous internal and external video.

The electroluminescent display swings out on two hinges to provide the proper viewing angle. However, hinged gas plasma displays are one of the major shortcomings of lunchbox portables, since the hinges for these heavier displays rarely behave. Rather than contending with problematic displays, Dolch opted instead to build its display right into the gray plastic case. Two hinged legs swing down from the case front, tipping the whole unit, as on the Dolch P.A.C. 386-25, which uses the same case design. While the front legs do not provide the flexibility of a hinged display, you won't have to struggle to close up this lunchbox.

The actual display is very clear and easy to read. The P.A.C. 486-25 features VGA resolution with 16 gray-scale levels in bright orange characters on a black background. The viewable area is a generous 9 by 7 inches (11.4 inches diagonal)—one of the largest in any lunchbox portable.

The keyboard is an 86-key AT-style layout, with 12 function keys, a separate numeric/cursor keypad, and fold-down legs for comfortable typing. With a standard AT-keyboard connection, you could substitute a more substantial keyboard than the provided unit, which tends to slide because of its light weight.

FACT FILE



Dolch P.A.C. 486-25
Dolch Computer Systems,
2029 O'Toole Ave., San Jose,
CA 95131; (408) 435-1881,
(800) 538-7506.
List Price: With 2MB RAM,
100MB hard disk, 1.2MB 5.25-
inch or 1.44MB 3.5-inch floppy
disk drive, double-scan CGA
electroluminescent display,
\$12,995; VGA gas plasma
display, \$595; Weitek 4167
coprocessor, \$3,795; DOS
4.01, \$150.
In Short: Dolch has squeezed
486 power and blazing speed
into a 20-pound lunchbox. This
AC-powered portable is a
desktop replacement for even
the most demanding power
user.

CIRCLE 446 ON READER SERVICE CARD

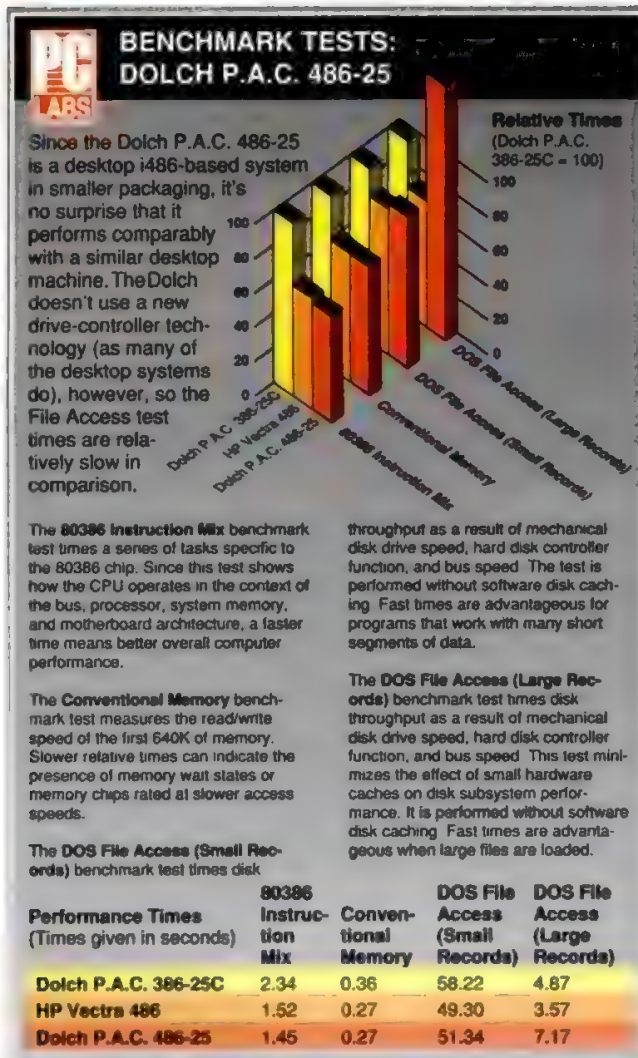
However, since the unit is portable, Dolch has compromised little in either its keyboard or the display.

One area that could stand some improvement is the documentation. Dolch's operating manual carries a 1987 copyright, and for that reason is a bit behind the times. The case diagrams are that of the electroluminescent display standard unit, and do not correspond with the VGA gas plasma unit we evaluated. The first section of documentation is generic, covering the entire Dolch P.A.C. product line. However, the power users who comprise the market for this 20-pound high-performance monster should not be slowed down too much by the glitches in the documentation.

Dolch supplements its own user manual with specific documentation for its components, including in-depth specifications for the system board, AMI setup and BIOS, the Chicony I/O card, and Paradise PVGA card.

Small touches like a hardware reset button and a case that disassembles with the removal of only three screws add to the Dolch's rugged exterior.

This first 486 lunchbox is not a machine for the masses, but its speed and expandability make the Dolch P.A.C. 486-25 a worthy candidate for any power user seeking portability. ■



First Looks

Quadbase-SQL

CONTINUED FROM PAGE 33

the program to the supplied libraries and you've got a stand-alone executable program that you can distribute without having to pay royalties. The *Quadbase* package includes everything required (except the C compiler), and since the programs are written in C, you can include your favorite libraries for adding other facilities to the application.

Quadbase's support for SQL includes a complete implementation of ANSI SQL with most of IBM's *DB2* extensions. It provides scrollable cursors for stepping through the results of an SQL *SELECT*, outer joins, views (virtual tables that are subsets of one or more other tables), and referential integrity. The latter lets you prevent changes to database contents and structures that might affect the integrity of relations between tables and rows. For example, you can specify that related records be deleted when deleting a master record or prevent the deletion of a master record when related records are present. Other features include support for a system catalog, NULL values, user privileges (via SQL's *GRANT* and *REVOKE*), and transaction processing with *ROLLBACK* and *COMMIT* facilities.

There's more. A *Quadbase-SQL* application can make direct calls to the *Quadbase* RDE. So if you're unfamiliar with SQL, you can still use the *Quadbase* engine for database handling (and accessing *dBASE* files) from a C program. You can even mix up direct engine calls with embedded SQL or use functions that pass SQL statements directly to the engine.

Since *Quadbase-SQL* supports implicit concurrency control and record locking, programs produced with it are automatically LAN-compatible without modification. On the other hand, explicit table-locking calls are available if you need them.



BENCHMARK TEST: QUADBASE-SQL

Relative Times

(Professional Oracle, Version 5.1 = 100)

Quadbase-SQL features a new append command for importing an ASCII file into a table. While the entire import is accomplished with a single *EXEC SQL* statement embedded in the C code (thus simplifying things immensely for the programmer), it's not as time-efficient as the import routines of other databases recently reviewed. Also, *Quadbase-SQL*'s Sort time could have been faster if we had created an index on the new table and copied the contents. But the benchmark test calls for a sorted table, which in *Quadbase-SQL* is accomplished via SQL with the *ORDER BY* statement. This means the query mechanism has to optimize the query.

The **Import** test measures how quickly the database can import an ASCII file (of either fixed-field-length or comma-delimited format) with an index on the first field. We include the indexing portion of the test to avoid penalizing programs that automatically index the first field during the data conversion. Some programs require a two-step process for this test: an import followed by indexing.

The **Sort** test measures the time it takes for the package to sort the files on an unindexed field in ascending order.

The **Search** test measures the time it takes to locate the first record that satisfies two criteria (make = Ford and model = coupe).

The **Delete and Index** (four-column version) test measures the time required to remove four columns (Units, SellPrice, BuyPrice, and TranDate) from a Product table created for this task and then, if necessary, to reindex the file.

Performance Times (Times given in seconds)	50,000 Records				5,000 Records			
	Import	Sort	Search	Delete and Index	Import	Sort	Search	Delete and Index
Professional Oracle, Version 5.1	4,505.46	8,945.55	16.09	2,775.01	468.14	202.25	16.09	135.47
Quadbase-SQL	4,472.64	9,044.63	7.08	2,356.90	404.52	352.95	8.79	194.66

Quadbase further extends the embedded language metaphor by offering a display library that's closely patterned after *dBASE* screen control commands. You can use @ . . . SAY . . . GET, READ, and PICTURE in your C programs and create and use input fields. This makes it easy to convert *dBASE* applications

and leverage your *dBASE* programming expertise.

C programmers will appreciate direct access to the C function calls associated with the embedded display commands. In addition, *Quadbase* includes a programmer's toolbox, with facilities for creating pop-up menus and windows, dialog boxes, and obtaining and verifying user passwords. As if this weren't enough, the package includes *Clipper*-style user-defined functions for accessing the *Quadbase* engine from *Clipper* programs.

Included with *Quadbase-SQL* is *dQuery*, Version 3.0, a \$195 interactive tool for executing SQL and query-by-example (QBE) queries, as well as writing reports against *dBASE III Plus* and *Lotus 1-2-3* files. Version 3.0 features an improved user interface with pull-down menus, on-line help, and complete support for SQL (including views). With *dQuery*, you can save and reuse SQL and QBE queries, and reports created with it can be run from an embedded SQL application.

The package also provides source code example programs and an excellent SQL primer. But in general, it lacks some polish. There are no *MAKE* files for recreating the example programs, and the documentation is not explicit about which versions of the C compiler and linker are supported. In addition, you can only make large model programs, so executables can become quite large (280K for a simple program to open a table and look up records). Other systems, like the *Paradox Engine*, can produce comparable programs in half the size. And, *dQuery* desperately needs 43- and 50-line text-mode support.

But considering its ability to create LAN-compatible embedded SQL applications without having to use an SQL server, *Quadbase-SQL* shines. If you're ready to move to C while retaining *dBASE* file compatibility or need to add a real SQL-based relational database engine to your C programs, look no further: *Quadbase-SQL* is the answer.



FACT FILE

Quadbase-SQL, Version 1.0
Quadbase Systems Inc., 790
Lucerne Dr., #51, Sunnyvale,
CA 94086; (408) 738-6989.
List Price: \$795.

Requires: 640K RAM,
Microsoft C 5.1, DOS 3.x or
later.

In Short: A full relational
database engine with
embedded SQL for C
applications. *dBASE III Plus* file
compatibility, a display library,
and interactive query and
report-writing tools make this
one of the most powerful DOS-
based database development
systems available.

CIRCLE 445 ON READER SERVICE CARD

First Looks

Small-Footprint 6-ppm TI microLaser Sets New Low Price for PostScript Printers, Offers LaserJet Series II Emulation

HANDS ON
by Alfred Poor

With the release of its microLaser, Texas Instruments is doing its part to put a low-cost PostScript printer on every desktop. The basic microLaser—a 6-page-per-minute, 300-dot-per-inch, small-footprint machine that offers a typical 512K of memory, parallel port, and HP LaserJet Series II emulation—lists for \$1,799. An upgraded version that has Adobe PostScript and 1.5MB of memory costs \$2,999. Optional serial and Appletalk interfaces are available for \$49 and \$145, respectively.

With a footprint barely bigger than a sheet of paper, the 10.9- by 13.4- by 4.2-inch (HWD) microLaser demands little desktop real estate. A 250-sheet paper tray fits entirely within the attractive gray case, and you can choose between facedown and faceup output.

The microLaser's print engine is manufactured by Sharp and uses separate drum, developer, and toner components. Like many other engine designs that use separate drums, this one is exposed to handling and possible damage during the installation process, but Texas Instruments has done what it can to minimize the risk. I experienced a little difficulty seating the ton-

er bin—if it is not latched securely when you try to remove its tape seal, you could end up wearing the toner instead of printing with it.

The microLaser's HP emulation, which includes Courier 10- and 12-pitch fonts in medium, bold and italic, and a line-printer font, worked as anticipated in the PC Labs printer benchmark tests. While the Sharp print engine is rated at 6 ppm, the microLaser

printable on an HP LaserJet Series II.

If you go the PostScript route, you get 35 genuine Adobe PostScript font outlines. You can change emulations quickly and easily, using the controls on the microLaser's front panel. Should you find the microLaser's options to be less than obvious, you probably won't have to go to the trouble of unearthing your manual. Instead, you can have the printer



Using the fast PostScript emulation, the TI microLaser printed at 5.8 ppm on the PC Labs text speed test.

churned out 6.5 ppm in our text speed tests. The test graphics images were a bit dark, but the blacks were smooth and solid. The microLaser passed the PC Labs PCL torture tests, with one exception: it printed in an area that is un-

generate a flow chart of all the menu choices plus a second sheet that shows the layout of the switches and their functions, simply by pressing a few buttons. The microLaser can also print out a useful status sheet that reports ev-

PC FACT FILE

microLaser
Texas Instruments, 5701
Airport Rd., Temple, TX 76503-
6102; (800) 527-3500.
List Price: Base model,
\$1,799; PostScript model,
\$2,999.
Dimensions (HWD): 10.9 x
13.4 x 4.2 in.
Weight: 33.5 lbs.
In Short: The base model has
a small footprint, good LaserJet
emulation, and 6.5-ppm tested
print speed. But the big news is
the low list price of its Adobe
PostScript model.

CIRCLE 431 ON READER SERVICE CARD

everything from the total pages printed to all the current parameter settings.

The microLaser's PostScript emulation was surprisingly fast; it managed to print at 5.8 ppm on the PC Labs text speed test. Its time of 106.3 seconds on the PC Labs graphics speed test compares favorably with those of 8-ppm PostScript printers.

The biggest news, however, is the price. The least-expensive PostScript printers tested in last year's Printer Project had 8-ppm engines but carried list prices of about \$4,500. For a list price of more than \$3,000, you could get a 4-ppm HP LaserJet IIP with a 2MB memory upgrade and the new HP Adobe PostScript cartridge. However, you'd be buying a printer that is 50 percent slower than the microLaser. At \$1,799, the base microLaser may have a difficult time competing with similarly priced HP LaserJet models, but the \$2,999 PostScript version sets a new price point for PostScript printers.

Texas Instruments microLaser

Once you've torn do
laws in the country
yourself face to fa
Devil, what will yo
Courier **Bold** Underl
Line Printer **Bold** Underline Comp
Courier **Bold** Underl

Text speed

0 2 4 5.8 ppm 6 8 10 ppm

Graphics speed

DEFAULT 0 25 50 75 106.3 sec. 125 sec.

Scalable LaserJet Fonts for WordPerfect

Manuscript Century *Waldorf Script* **Don Casual** Eterna

Prestige Corporate Buckingham Coronation Script PENWIN

Gibraltar Souvienne University Ornate Oxford Rockland

Letter Gothic **Copperfield** Garamand Corporate Condensed Carnegie

Baskerton Classic Typewriter Obelisk Gettysburg Futuri

Avant Guard **Aero** GREEK AB\$J 01 *Exchequer Script* Katrina

Joulliard Zingbats “①② Roman New York Deco

Garamond Condensed Padua Courier Bongo Black

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TECHNICAL REQUIREMENTS: IBM PC, AT, XT, PS/2 or compatible with a minimum of 512Kb RAM, a hard disk, MS-DOS 3.0 or later, a LaserJet Plus, Series II, IID, HP or compatible printer with standard memory.

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CIRCLE 299 ON READER SERVICE CARD

First Looks

SpinRite II and Disk Technician Doctor Bits Gone Bad

HANDS ON
by Lori Grunin

When valuable data is at risk, "better safe than sorry" takes on new meaning. Throughout the past few years, Gibson Research Corp. and Prime Solutions have been offering their own ounces of prevention to shield users from ever having to learn this painful lesson. In addition to performing several depths of tests on hard disks, Gibson's *SpinRite II* and Prime

low-level formatting.

Prime Solutions also did away with the de facto form of copy protection previously used in both its full-blown *Disk Technician Advanced* and its stripped-down *Pro*—which is the same as *Advanced* minus timed parking of the heads and automation of some operations (as opposed to batch operation, which both programs support).

Now you can install the program either on your hard disk or on a bootable floppy, and it will

still does not support partitions larger than 32MB or controllers that use sector translation. (*SpinRite* will refuse to low-level-format a sector-translating subsystem.)

Unlike *SpinRite*, which "passes" or "fails" sectors depending on the successful reading and writing of various bit patterns in each byte, *Disk Technician* monitors the types of misreads that occur (single versus multiple) and keeps a performance history on which it bases the decision to repair or retire a sector.

While both programs may seem like gifts from the gods, they're not without their flaws and irritations. *SpinRite* only reports the FAT's bad cluster markings (as opposed to *SpinRite*'s own) when low-level formatting a disk. On one machine, *Disk Technician* caught all the errors and found several single misreads. On another drive that had been functioning with no problems, it found several hundred single misreads and popped up a message warning us to see a service technician.

Both programs are meant to be run on a routine basis, ranging from *Disk Technician*'s once-a-week minimum to *SpinRite*'s recommended trimesterly operation. Both work in interactive and batch modes—although *SpinRite* will not let you save your preferred test configuration, which means the only convenient way to run repetitive tests is with a batch file.

Furthermore, *SpinRite*'s configuration defaults—the ones that the manual claims "the average user does not need to be concerned with"—in-

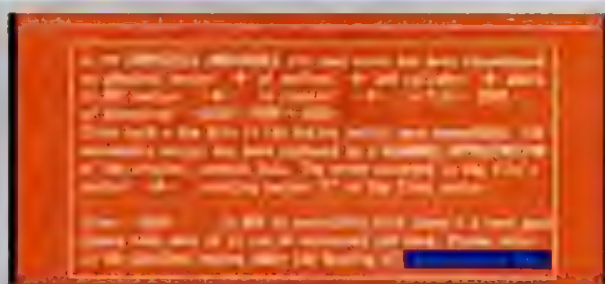


Disk Technician runs tests at three levels of intensity on an entire partition (automatic mode) or on a user-specified subset (manual mode).

Solutions' *Disk Technician* nondestructively low-level-format the drives, reset inter-leaves, and move endangered data to more-robust areas of the disk.

Among other features, the latest versions of each package now sport improved user interfaces. *SpinRite*, which operates with MFM, RLL, ERL, and ESDI controllers, now supports partitions larger than 32MB (created with DOS 4.x and software drivers), as well as controllers with full-track buffering. The program also generates cumulative reports with information on the location of all damaged sectors. In addition, it no longer requires that you boot from the *SpinRite* floppy disk: you just copy the contents onto your hard disk—and *SpinRite* no longer overrides the manufacturer's bad track table when

check up to two physical MFM or RLL disk drives per system, provided that they are no larger than 136MB (MFM) or 248MB (RLL). If you boot it off a floppy disk, *Disk Technician* will create backup copies of the file allocation table (FAT) and other information necessary to restore a crashed disk. The program



This screen from *SpinRite II*'s supplementary hypertext documentation shows how it provides detailed information about a trouble spot.

FACT FILE

Disk Technician

Prime Solutions Inc., 1940 Gamet Ave., San Diego, CA 92109; (619) 274-5000.
List Price: *Advanced*, Version 6.08, \$149.95; *Pro*, Version 4.58, \$59.95.
Requires: 512K RAM, DOS 2.1 or later.

CIRCLE 447 ON READER SERVICE CARD

SpinRite II

Gibson Research Corp., 22991 La Cadena, Laguna Hills, CA 92653; (714) 830-2200.
List Price: \$89.
Requires: 384K RAM, DOS 2.1 or later.

In Short: These two disk utilities can analyze and repair your disk before disaster strikes. Risk-averse users will probably want to inhibit the programs' ability to override the bad-track markings in a disk's file allocation table.

CIRCLE 446 ON READER SERVICE CARD

clude ignoring DOS-marked bad clusters and accepting them for active use, performing (non-destructive) low-level formatting, and practicing manual report generation rather than automatic session logging. I'd rather see more conservative defaults.

On the other hand, *SpinRite* allows you to suspend and resume most disk tests and the technical log provides most of the information you'll need about the errors found.

Disk Technician has its own operational annoyances. For instance, not only does it reboot the system prior to running (in order to load its customized environment), it also reboots upon exit.

These programs are designed for those averse to risks, those for whom each byte holds potentially valuable data. Yet, ironically, it is the risk-averse who should be wary of these packages and their tendency to override DOS when it fences off more than just the corrupted area. Since you can override this action, however, *SpinRite II* and *Disk Technician* really do help track down potential trouble spots and make stabs at repairing them with a nondestructive low-level format. ■

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INFO SELECT is easy to use - yet powerful.

more embarrassing pauses or scrambling for information.

INFO SELECT also includes the world's first "3-D" wordprocessor. You'll be amazed how it works.

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Better than a PIM

INFO SELECT is better than a desktop organizer and better than a personal information manager (PIM). For example, Sidekick can't show the multi-views of Agenda. Agenda takes weeks to learn

and can't add one plus one. Grandview can show an outline of the features of Sidekick but can't dial a phone number! INFO SELECT combines many of the benefits of all these types of software and then goes even further. It costs less too!

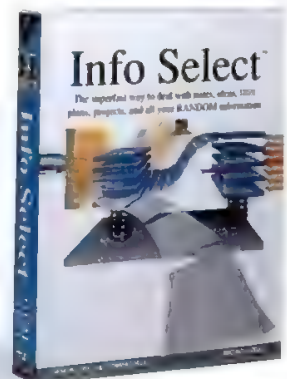
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BASIC OPERATION: You will see several windows of different sizes side-by-side on your screen. Info Select windows can hold: notes, plans, lists, facts, letters, contacts, and much more. You can: open a new window, type into it, and shape it; edit an existing window; resize, remove, or print a window; browse through windows with the arrow keys; search for a group of windows related by a word or phrase; hot-key between INFO SELECT and a wordprocessor or spreadsheet; and much more. **EASY POWERFUL FEATURES:** five ways to see overviews; hypertext; fast sort; line drawing; date tickler; dialer; searching by text or date ranges; add columns of numbers; 3-D wordprocessing; support of some commands of popular wordprocessors; can store data in EMS; template or free-form windows; import and export files, screens, and databases; move, join, and duplicate windows; efficient on portables; LAN file locking and sharing; stand-alone or memory-resident; pull-across menus; and much more. Data is structured in multiple stacks of intelligent text windows; uses a unique easy powerful system of parallel text processing and progressive resolution searching without keywords. **SPECIFICATIONS:** infobases up to 10 megabytes; text searches up to 300K/sec; up to 32,000 characters per window; up to 64,000 windows per infobase; takes just 7K in swap mode; for the IBM PC/XT/AT/PS2 and true compatibles; not copy protected. **MAIL ORDERS:** Send name, address, phone number, and payment by check, Visa, or MC to address shown. Please include \$3.50 shipping (\$10 outside USA). 30 day money back guarantee. **TORNADO OWNERS:** INFO SELECT includes everything in Tornado and much more. Call today for our special limited time trade-up offer. **EUROPEAN CUSTOMERS:** Contact Atlantech U.S.A. (203) 655-6980. **TRADEMARKS:** Trademark (owner): Tornado and Info Select (Micro Logic); Agenda (Lotus Development); Sidekick (Borland International); Grandview (Symantec); IBM PC, XT, AT, PS/2 (IBM). © 1990 Micro Logic Corp. U.S.A.

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Doing More For The Data Process

First Looks

Avagio Takes Low-end DTP a Small Step Forward

HANDS ON
by Luisa Simore

Unison World has constructed the name of its low-end DTP program, *Avagio Publishing System*, by combining two Italian words—*avanti* and *adagio*—loosely translated, “come forward—slowly.” That phrase sums up the small progress made by this \$299 package.

For the money, *Avagio* packs a lot of functionality, including four scalable typefaces, 150 high-resolution art files, and all of the layout functions of competitors like *Publish It!* and *Finesse*. Drop-down, pop-up, or pull-down menus give you access to a host of automated design functions, such as hyphenation, text wrap, and page numbering. Typeface and paragraph formats can be saved in a stylesheet. And master pages make even a lengthy document easy to create by repeating graphic or text elements on each page. The program includes interactive tabbing functions and powerful ruler guides, although pica and centimeter measures are notably absent.

Like the best low-end DTP programs, *Avagio* uses frames to construct a page. Graphics frames are created as part of the art import process. The lazy among us will appreciate the Autosize and Autoflow Frames options for text. When Autosize is selected, the size of a text frame will increase to accommodate words as you type. If Autoflow is active, *Avagio* will import ASCII or word processing files from *WordPerfect*, *Microsoft Word*, *MultiMate*, or *WordStar*, and will add the necessary frames or pages.

In addition to standard pointer, text, and drawing tools, *Avagio*'s main toolbox contains an icon for linking text frames, making it possible for you to flow a long story across noncontiguous pages. Since *Avagio*

considers both graphics frames and text frames to be objects, you can flow copy around art by assigning a boundary attribute to the graphics element and assigning a text-wrap attribute to single or multiple text frames. Unfortunately, the only way the program accommodates irregularly shaped art is by requiring you to wrap text around a series of stacked, nonprinting rectangles that mimic the shape of the image.

Object orientation lets you lock or group items. For example, if you group a photograph with its associated caption, the two items will move in unison when you change the layout. You can import photographs as either high-resolution .PCX or .TIF files. The program's graphics tools let you crop, resize, and flip 300-dot-per-inch images.

Avagio also handles vector graphics, but only in Unison World's proprietary .UWI format. *Avagio*'s claim to support PostScript graphics comes with a major qualification: an auxiliary graphics utility can convert *Adobe Illustrator* .EPS files to *Avagio*'s internal format. That is the extent of *Avagio*'s Post-

Script support. The program doesn't even come with a PostScript driver for the Apple LaserWriter.

Avagio's boast of providing totally scalable fonts also needs to be tempered, since its four typefaces are stored in a proprietary format and sent to the printer as bitmapped images. This won't make much difference for users of dot matrix printers (because memory considerations affect printer spooling, not output quality). But users of page or laser printers will need 1.5MB of printer memory in order to print a full page of graphics or text at 300 dpi.

Though the quality of the Helcera, Bay Roman, Centurion, and Bravo typefaces won't satisfy finicky designers, these proprietary vector formats can be sized from 5 to 999 points. Fonts can be treated like graphics, and you can embellish them with unique black-and-white fill options.

Mingle, a powerful graphics function, lets you determine whether *Avagio* treats the black (or white) portion of an image or letter as black, white, clear, or inverse. The fun starts when you combine overlapping layers of text and art with various Mingle attributes and the program's 25 supplied fill patterns. The effects, especially when used in conjunction with *Avagio*'s gradient filled boxes, can be spectacular.

Go-to commands and several zoom levels give you an effi-



FACT FILE

Avagio Publishing System
Unison World, 1321 Harbor Bay Pkwy., Alameda, CA 94501; (800) 444-7553, (415) 748-6670.

List Price: \$299.

Requires: 640K RAM, hard disk, graphics adapter, mouse, DOS 3.0 or later.

In Short: *Avagio* provides casual DTP users with sophisticated layout functions, the ability to link text frames, and a Mingle command for creating special effects with graphics or text. Unless you need downloadable fonts or PostScript support, this may be the all-in-one low-end DTP solution you've been hoping for.

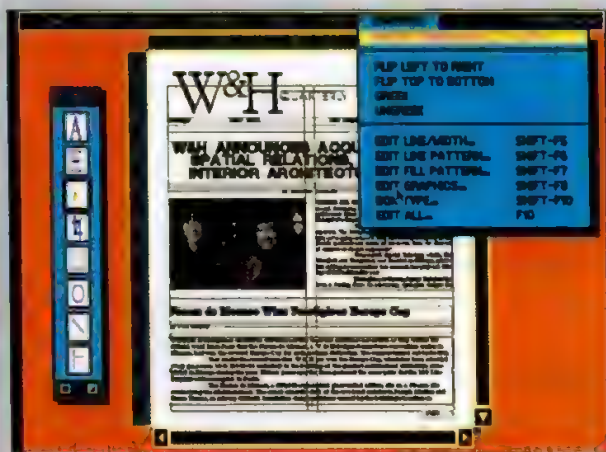
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cient way of maneuvering through a document. Unfortunately, the screen display is neither as accurate nor as fast as it should be. Using the Shift key in conjunction with the mouse to select items—or using the mini-page positioning tool—can help you avoid constant, unnecessary screen updates.

By incorporating such elements as drop shadows around dialog boxes, *Avagio* appropriates some of the superficial details of graphical user interfaces. Unfortunately, the program falters on the more important details, such as organizing information in a visually logical manner or providing consistent conventions for invoking commands. For example, the highlight, which is sometimes a solid bar and sometimes an open rectangle, often remains on-screen after you have deselected an item in a dialog box, making the item look as if it were still selected.

Avagio's manual and on-line help are anything but helpful. Neither I nor a company spokesperson could find any reference to the Boundary command in the manual.

Users interested in downloadable fonts or true PostScript support will find that *Avagio* doesn't use laser printers to their potential. Still, for graphics-intensive documents, *Avagio* squeezes a lot of performance out of its proprietary interface, fonts, and vector art. ■



Avagio's toolbox can be displayed either horizontally or vertically. It includes cropping and frame-linking tools.

First Looks

Gray F/X: Sophisticated Darkroom Functions for Editing Gray-scale Images

HANDS ON
by Luisa Simone

Gray F/X from Xerox Imaging Systems gives advanced DTP users a power tool with which to optimize digitized photographic images. Though the \$495 program includes drivers for 20 different multibit (gray-scale) scanners, its real power lies in its photographically inspired, arithmetically based editing tools.

At first glance *Gray F/X* may seem to be just another well-implemented paint program with various brush shapes, gray palettes, and sizing, skewing, and pasting functions. A second glance reveals sophisticated digital darkroom functions, like the equalization option on the Gray menu. This feature alters the relationship of the gray shades in a picture according to one of four base distribution curves—linear, bell, exponential, and logarithmic.

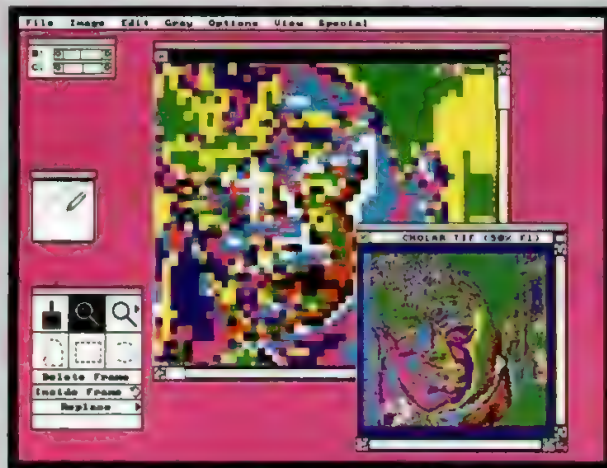
Unless you were a math major in college, it will take some experimentation to understand how each of the gray-map distribution curves will affect the brightness, contrast, and ultimate print quality of your picture. The trial-and-error process, however, is quick and painless. Modifications are not applied to the base file until you are satisfied with the results, so screen updates are fast, and you can easily reverse gray-scale changes. Changing the gray map is as easy as clicking on one of the menu choices noted previously or displaying an interactive gray map, where you can directly redraw the distribution curve with a pencil tool.

Powerful tools such as sharpen, blur, posterize, ditto, and transparent pastes are also available from the drop-down menus. However, reversing these effects requires you to ac-

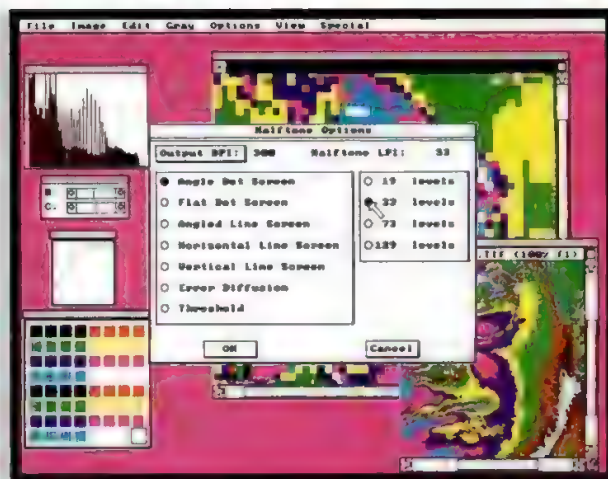
tivate and size the undo buffer before you begin work.

Gray F/X supports high-resolution VGA displays (640 by 400 or better) with up to 64 shades of gray on-screen. And depending upon the amount of extended or expanded memory you have installed, you can open up to ten windows (called workspaces) simultaneously. Although only one image can be active at a time, cutting and pasting between windows is a snap.

Gray F/X affords you a high degree of control over your working environment. Individual toolboxes, such as the brightness and contrast controls, or a gray-scale histogram, can be hidden, displayed, and repositioned anywhere on-screen. Also workspaces can be saved to a filename—*sans* pictures but *with* associated toolsets and imaging parameters. Storing a gray map this way is a real time-saver once you have hit upon the optimum settings for your scanner and printer.



Gray F/X lets you see how a printer's dpi and the number of gray-scales in an image affect halftone quality. Here, a 300-dpi laser printer printing an image with 19 gray shades must use a line screen of 70. At 33 levels of gray, the number of halftone lines per inch drops to 53.



With sufficient extended or expanded memory, *Gray F/X* can open multiple image files. Here, the window on the left shows a scanned image with spatial posterization applied to one section. The second image shows how redrawing a gray map can affect the tonal qualities of a photo.

Gray F/X exports images in all of the essential DTP-related bitmapped formats: TIFF, compressed TIFF, .PCX, *Dr. Halo* .CUT, .IMG, and .EPS. The manual thoroughly discusses the relationship between dpi (dots per inch), screen pixels, bit levels, and line screens, and the halftoning options menu provides a concrete method for learning the trade-offs between increasing gray-scale information, or upping resolution. Halftoning options apply not only to the files you print directly from within *Gray F/X*, but also to those pictures you choose to

save as 1-bit black-and-white files (a great feature for DTP programs that, unlike *Page-Maker*, don't support multibit TIFF formats).

Though on-line help and vector rather than bitmapped versions of the Helvetica and Times Roman fonts would be welcome additions, *Gray F/X* can hold its own even against the Mac-based paradigms, *Digital Darkroom* and *Image Studio*. *Gray F/X* goes the extra mile to deliver both the hardware support and software features graphics users need to create and incorporate high-quality black-and-white and gray-scale images into DTP documents. ■



FACT FILE

Gray F/X

Xerox Imaging Systems Inc.,
535 Oakmead Pkwy.,
Sunnyvale, CA 94086; (408)
245-7900.

List Price: \$495.

Requires: 640K RAM
(extended or expanded
memory recommended), hard
disk, VGA graphics adapter,
DOS 3.0 or later.

In Short: This easy-to-use
image-editing program
provides sophisticated
retouching functions, access to
multiple images on screen, and
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THE GOLD STANDARD

Object Professional: First Library of Objects For Turbo Pascal Saves Programming Time

HANDS ON
by Neil J. Rubenking

Object Professional, a library of objects—not just procedures and functions—is an essential toolkit for programmers using Turbo Pascal 5.5. The \$150 package—the first of its kind—is huge, comprising a three-volume manual and eight disks of highly compressed source code. It contains practically all the general-purpose objects you'll ever need.

If a function can be made into an object, *Object Professional* can do it, and the manual will explain how. The *Screen Management* volume discusses how to use such objects as flexible windows, menus, context-sensitive help, pick lists, among others. You'll find these objects sufficient for building an attractive user interface for your programs.

The *Data Input/Output* volume concentrates on file-browsing window objects, text-editing objects, data entry screen objects, and even objects for hardware-specific printer support.

The third volume, *TSRs and More*, is a catch-all that dis-

cusses miscellaneous functions like container objects: linked lists, queues, and data dictionaries that handle any *Object Professional* object type—including themselves. Across the three volumes, more than 130 objects and their methods are described in detail and cross-referenced to related topics.

Learning how to use *Object Professional* could be a problem. With 1,600 pages of manuals, you might spend more time reading than coding. Fortunately, one of the provided example programs, POPHELP, is a RAM-resident, context-sensitive help program for *Object Professional*. One keypress helps you with whatever routine the cursor is on, including example code that you can paste into your program. If that's not enough, you can pick apart the other example programs to see exactly how TurboPower's programmers use their own objects.

In fact, the example programs show off what *Object Professional* can do. MAKEMENU and MAKEHELP let you whip up a prototype program with mouseable pull-down menus and context-sensi-

tive help in an hour or two. The DESKPOP example program is a swapping TSR that contains a file manager, a text browser, an editor, a calculator, a calendar, a phonebook with dialer, and a detailed programmer's reference chart. DESKPOP does more than many standalone products, yet its full source code is provided as an example.

Object Professional's swapping TSR technology lets RAM-resident programs of any size exist in only 6K to 8K of conventional RAM, with the rest swapped to disk or EMS. The product also provides for allocation of extended or expanded memory, keyboard macros, virtual arrays, and customization of default values and offers a sorting routine. In general, whatever you want your program to do, check first to see whether *Object Professional* already does it.

Object Professional requires 11MB of hard disk space. If you delete the source and example files after installation, the compiled units will still occupy 1MB. Fortunately, a competent installation program takes care of decompressing the files and compiling them for you.

Object Professional pushes Turbo Pascal 5.5 to the limit. For the sake of practicality, however, its programmers restricted their use of virtual methods, because the Turbo Pascal 5.5 smart linker isn't quite smart enough to strip out unused virtual methods. Whenever possible, they implemented pointers to user-defined procedures to avoid forcing the user to define descendant objects. Thus, TurboPower's programmers sacrificed strict object-oriented style for smaller code.

Code size is definitely an issue. Programs converted from TurboPower's earlier library, *Turbo Professional*, to *Object Professional* are liable to get larger because of the smart link-

FACT FILE



Object Professional
TurboPower Software, P.O.
Box 66747, Scotts Valley, CA
95066; (800) 333-4160
(orders), (408) 438-8608;
CompuServe 76004,2611.
List Price: \$150.
Requires: 512K RAM, Turbo
Pascal 5.5, DOS 2.0 or later.
640K RAM, TASM 1.0+ or
MASM 4.0+, and mouse
recommended.
In Short: The first library of
objects for Turbo Pascal 5.5
programmers contains
practically all the general-
purpose objects you'll ever
need in order to build your own
programs.

CIRCLE 449 ON READER SERVICE CARD

er's inability to remove unused virtual methods. The change in size will be most dramatic in small programs, but large programs may become too big to compile. The manual gives precise instructions on how to adjust the compiler to handle the largest possible programs.

Object Professional is much better-integrated than was *Turbo Professional*. For example, *Turbo Professional* help windows, pick windows, and menus all have separate data types that control their colors, whereas *Object Professional* has a single "ColorSet" object. In *Object Professional*-based programs, all command input (keyboard or mouse) goes through a single command handler, and all error conditions use a single error handler. This integration may recover some of the code space lost in the conversion to objects.

Object Professional is much more than a collection of source code. For programmers learning object-oriented programming, it's better than a textbook. You could create your own library of objects, possibly one that's just as good as *Object Professional's*. But the time you'd spend building that library would far exceed the cost of *Object Professional* itself. Better to stand on the shoulders of giants—use *Object Professional* for everything you can and concentrate your own efforts on the features that make your programs unique. ■



Object Professional offers source code for its DESKPOP program, a swapping TSR that uses only 6K to 8K of RAM.

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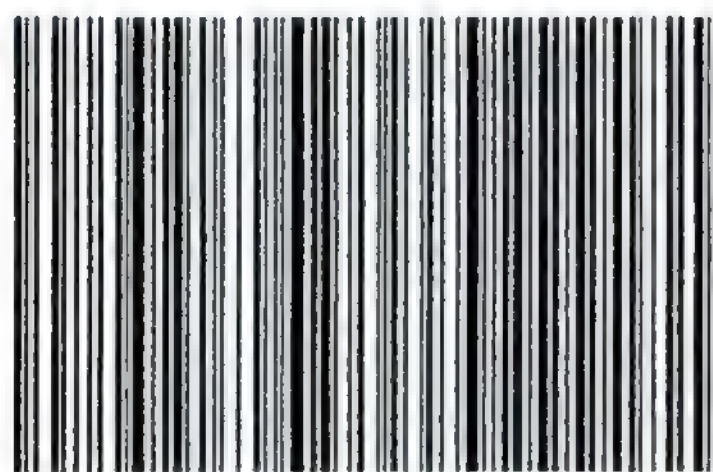
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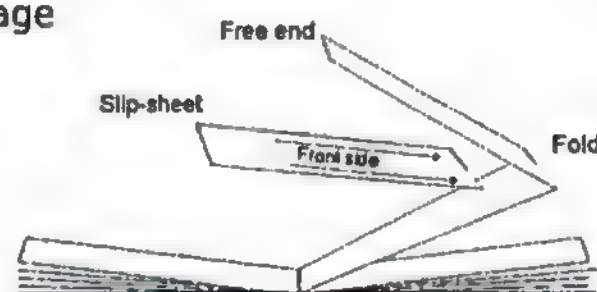


GbsSlipSheet-001

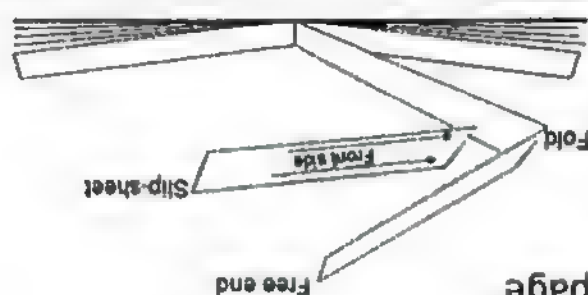
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Foldout slip-sheet

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3. Slice the folded edge
4. Close the page and slip-sheet

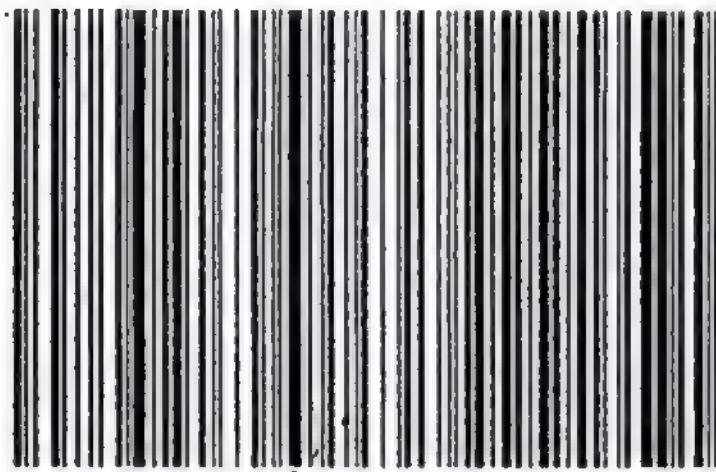


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 1. Front side touching the free page
 2. Arrow pointing to the fold
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4. Close the page and slip-sheet



1. Follow instructions on the other side

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Gbs5lpBack-001B

Back

1. Follow instructions on the other side



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Advanced Overlay Linker Supports Runtime Libraries, Performance Analyses

HANDS ON
by Salvatore P. Riccardi

The link step in creating an executable file is the sort of thing that some programmers assign to a batch file and forget about—that is, until their programs grow too big to fit into available memory. Then, overlay linking becomes an issue. Pocket Soft's *RTLink/Plus* is an advanced overlay linker for creating DOS executable files.

An overlay area is memory set aside to be shared by several program sections, or overlays. These are swapped in and out of the overlay area as needed. At any one time, only the sections in use are loaded into memory. Until then, they reside on-disk or in a memory cache.

The overlay support in *RTLink/Plus* provides several advanced features. For example, your program can make calls between overlays, because *RTLink/Plus* supports overlay reloading on return. You can also make calls through pointers; explicit language-library support is not necessary. And you can overlay data.

RTLink/Plus supports nested overlays and multiple overlay areas. By using nested overlays, you can create an overlay hierarchy where parent overlays are automatically loaded when a child is loaded—all into one overlay area. This lets you put supporting code into a dependent overlay that would otherwise have to be placed into a permanent memory section.

You can set up more than one overlay area for further precision and specify overlays at the file, library, object module, code class, or code segment level. Pocket Soft provides the assembler language source code for the overlay manager.

RTLink/Plus supports runtime libraries—collections of routines that are prelinked and stored in a separate .RTL file.

The .RTL file is combined with the executable code at runtime. Debugged code can be placed into an .RTL file, reducing the time required to link the program. Since code shared among several .EXE's can be stored in a single .RTL, disk space is also conserved.

With its execution profiler, *RTLink/Plus* lets you perform detailed performance analyses of your code. The profiler is linked with your program, and records a variety of user-specified statistics. You can then produce reports that show where

your program is spending its time. Debugging support for Microsoft's CodeView and for The Periscope Co.'s *Periscope* is provided.

With a strong profiler and advanced overlay capabilities, *RTLink/Plus* is a good choice for use with large applications. Its .RTL capabilities can save you time and disk space. ■

List Price: *RTLink/Plus*, \$495.

Requires: 256K RAM, DOS 2.1 or later. Pocket Soft Inc., 7678 Hillmont, #195, Houston, TX 77040; (713) 460-5600.

CIRCLE 443 ON READER SERVICE CARD

Blankity Blank Streamlines Document Merges, Adds Database Links

HANDS ON
by Mike Jones

Not even the best word processors make it easy to craft their merge capabilities into any sort of document-handling system. That, of course, is where *Blankity Blank* 3.0 and *Blankity Blank DB-Link* come in. Essen-

tially a menu-driven front end for your word processor's merge functions, *Blankity Blank* simplifies data entry, automates the merge process, and provides a structure for maintaining your data and merge documents. With *DB-Link*, which brings the list price from \$99.50 to \$199.50, you

can also draw data from database files via hot links.

The *Blankity Blank* system guides you through the creation of up to 500 questionnaires, which serve as intelligent data entry forms, complete with database-like field types, data validation, and math functions.

Each time you answer a questionnaire, the program creates an answer record. That record can then be used to fill out as many as 500 merge documents associated with that questionnaire.

As of this writing, *Blankity Blank* works with 15 word processors; if yours isn't on this list, it's probably time to switch. The same applies to database files; *DB-Link* supports the .DIF file format and the native formats of six major packages, including dBASE.

Blankity Blank 3.0 suffers from a few poorly planned features. For instance, if you need to use dates earlier than January 31, 1980, you'll have to enter them as straight text.

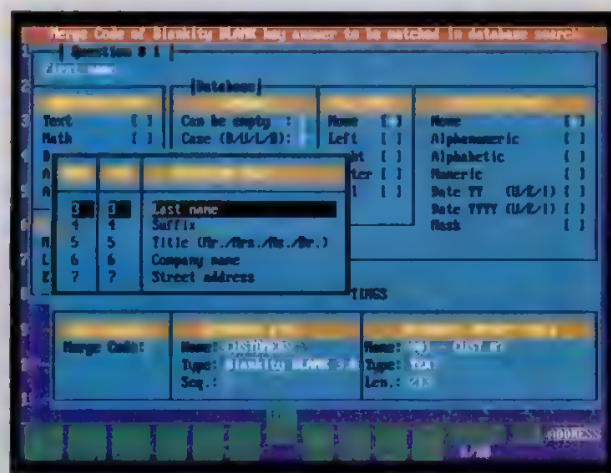
The basic structure of the program also makes it unsuitable for many uses. Each answer record, really a DOS file, must use a unique name, meaning you'll probably end up using numbers to identify your records. The same applies to database file records: you must query the database with a specific value of the key field, and the program will take only the first matching record. This means you won't be able to query a mailing list for addresses within a given zip code, for example.

If these limitations don't bother you, however, you may wonder how you got along without *Blankity Blank* once you try it. With or without the *DB-Link* capabilities, the program will not only lend structure to your merge data, but also reduce day-to-day document merges to a quick and nearly effortless task.

List Price: *Blankity Blank* 3.0, \$99.50; *Blankity Blank DB-Link*, \$199.50.

Requires: 640K RAM, hard disk, DOS 2.1 or later. Softstream Technologies Inc., 2740 Hollywood Blvd., Hollywood, FL 33020-4826; (800) 888-9292.

CIRCLE 441 ON READER SERVICE CARD



Shown here is *Blankity Blank*'s question definition screen for a field that will be linked to a database.

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*Prices listed are available with complete system purchase only.

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by
Matthew J. Ross

New & Improved

News of Announced Products and Upgrades

Mannesmann Tally 6-ppm Laser Upgrades to PostScript

NEW

Mannesmann Tally's new six-page-per-minute laser printer, the MT906, combines the company's JADE controller and the National Semiconductor NS32CG16 processor to speed the printing of 300- by 300-dot-per-inch output, according to the manufacturer. A field installable Page Description Language (PDL) module includes the Bauer PostScript Interpreter and 35 fonts.

Standard features include 512K RAM, HP Laserjet Series II emulation, six fonts, and a

The MT906 offers 6-ppm PCL compatibility and can be upgraded for PostScript.



150-sheet paper bin. The MT906 offers upgrade options, including 1-, 2-, and 4MB memory additions. A dual bin offers high-capacity paper handling (250 sheets each) or it can feed up to 50 envelopes at a time.

List Price: Mannesmann Tally MT906, \$2,195 with 512K RAM; with 2MB RAM and PostScript interpreter, \$3,495. Dual paper bin, \$399. Mannesmann Tally Corp., 8301 S. 180 St., Kent, WA 98032; (206) 251-5500.

CIRCLE 406 ON READER SERVICE CARD

Vertex Detailer Eases CAD for Construction

NEW

Aware that construction products frequently employ similar methods and raw materials, Vertex Design Systems has created an Auto-

CAD-based application that simplifies the process of drawing designs for building construction. *The Vertex Detailer* features 25,000 building component types, ranging from 2 by 4s and gypsum board to complicated aluminum windows, allowing architects and builders to assemble details, rather than having to draw them from scratch.

The Vertex Detailer features a database manager that organizes all the building component products using the Construction Specification Institute's (CSI) master format divisions. Users simply select a component, indicate the size, and snap it into place in the drawing. Built on top of AutoCAD running on DOS, the database manager customizes AutoCAD to support the database components. A preview feature allows the user to view building components outside AutoCAD, saving the time needed to generate complex drawings within the application.

The Vertex Detailer automatically adjusts line weights, patterns, and lettering when scales are changed, insuring consistent drawings. Users can also purchase *Vertex Design Details*, a pre-assembled set of common commercial construction details. Five sets are cur-

HOT PROSPECT

NEMIS 3's LAYER MANAGEMENT SYSTEM MANAGES COMPLEX AUTOCAD DESIGN DRAWINGS

Nemis 3 Software announces the release of a new software application that provides architects and designers with greater control over complex AutoCAD design drawings. *Layer Management System* provides a multidimensional system for managing design information. More than a layering system, *Layer Management System* facilitates the sharing of information between computer-drawn and manually drawn designs.

User layers can be customized according to pen weight, drawing content, or color choice. Once user layers are customized, they are recorded in a "User Layer Notebook," contained within the specific drawing file, accessible to all users. All layers are described on a small laminated overlay, which includes many commands involved in manipulating and managing different layers. *Layer Management System* classifies layers into Base, Middle, and Top sheets, providing a consistent starting point for architects and designers.

List Price: *Layer Management System*, \$189 master copy, \$99, additional copies, \$5 shipping fee. **Requires:** 640K RAM; AutoCAD, Release 10, and DOS 3.3 or later. Nemis 3 Software Corp., 40 Prince Arthur Ave., Toronto, Ontario M5R 1A9, Canada; (416) 631-2230.

CIRCLE 433 ON READER SERVICE CARD



The Vertex Detailer is a catalog of architectural plans for quick AutoCAD design work, like this listing of designs for double-hung windows.

rently available: Built-up Roofs, Interior Construction-Metal Stud and Gypsum Board, Interior Doors-, Interior Windows-, and Exterior Walls-Metal Stud. *The Vertex Designer* is fully integrated with AutoCAD Release 10's Advanced User Interface.

List Price: *The Vertex Detailer*, \$1,995. *Vertex Design Details*, \$695 each. **Requires:** 640K RAM, AutoCAD, Release 10, a hard disk, and DOS 3.3 or later. Vertex Design Systems, 140 Second St., San Francisco, CA 94105; (415) 957-2799.

CIRCLE 435 ON READER SERVICE CARD

New & Improved

Guardian Protects Lotus 1-2-3 Data

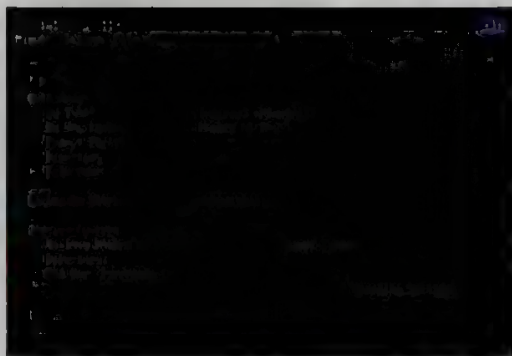
NEW

Guardian, the data protection add-in from **Intex Solutions**, performs automatic backups on your **Lotus 1-2-3** and **Symphony** spreadsheets to keep your data safe. As an add-in that operates in the background, **Guardian** backs up the current worksheet at regular intervals or after a user-defined number of keystrokes. You can back up to floppy diskettes, or to any path or logical drive.

Guardian provides a sequenced history of up to 50 backups per worksheet, and with its archival feature you can compress older worksheet files to conserve space on your hard disk. **Guardian** works with **Lotus 1-2-3**, **Releases 2.x** and **Symphony**, Version 1.1 and later.

List Price: **Guardian**, \$69.95, plus \$5 shipping. **Requires:** 28K RAM, **Lotus 1-2-3**, or **Symphony**. DOS 2.0 or later. **Intex Solutions Inc.**, 161 Highland Ave., Needham, MA 02194; (617) 449-6222.

CIRCLE 438 ON READER SERVICE CARD



Guardian backs up your **Lotus** spreadsheets, with user control over time intervals and directories.

VPDesigner Quickly Creates Ventura Documents

NEW

To aid designers using Xerox's desktop publishing software, **HyperFormance's VPDesigner** offers prepared style sheets for a variety of different document types, to create **Ventura Publisher** documents quickly and

easily. **VPDesigner** gives artists increased typographic control and reduces production time by automating much of the redundant work involved in the design process. **VPDesigner** style sheets include newsletters, presentations, flyers, forms, menus, catalogs, manuals, technical sheets, directories, proposals, resumes, and annual reports. Also featured are illustrated sample chapters, and a manual featuring design and type fundamentals, tutorials, document variations, tag descriptions, and style specifications. The manual is also provided on-disk as a **Ventura**

Publisher chapter so that users can view it online. **VPDesigner** style sheets are compatible with all printers supported by **Ventura** and ship with six headline typefaces. **VPDesigner** works with **Ventura Publisher**, Version 1.1 or later, and requires at least 1MB of hard disk space.

List Price: **VPDesigner**, \$129.95. **Requires:** 640K RAM; **Ventura Publisher**, Version 1.1 or later; 1MB hard disk; DOS 2.1 or later. **HyperFormance, Inc.**, 4906 Fitzhugh Ave., #107, Richmond, VA 23230; (804) 355-0083.

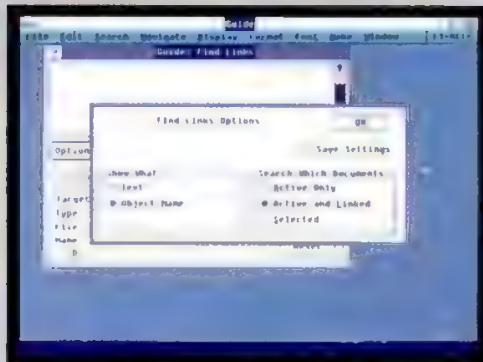
CIRCLE 437 ON READER SERVICE CARD

IMPROVED

Guide, Version 3.0—The new version of Owl International's hypermedia development environment features a new hypermedia engine that lets you present information in a number of object formats—including text, graphics, sound, and full-motion video. Users can customize hypermedia information systems with **Guide's** new features, which include enhanced programming capabilities through a new programming language, **LOGiX**.

Comprehensive linking tools enhance the environment's linking and referencing capabilities, while increased file import and export ability improves user integration of graphics and text. New text and document formatting streamline text searches, control of text within windows, and verification of object links. Furthermore, **Guide** is now compatible with **Microsoft Windows**. **Guide 3.0** retails for \$495. **Owl International Inc.**, Bellevue, Wash.; (206) 747-3203.

MS-DOS Kermit, Version 3.0—A new **Kermit** protocol extension supports the transfer of text files in international character sets. DEC VT320 terminal emulation including soft function keys is now featured, as well as five PC code pages. A sliding window packet protocol improves file transfers across public data networks and long distance satellite connections. **Kermit** expands its LAN support to include IBM



Guide 3.0 features links including text files, graphics, sound, and live video to create multimedia presentations.

NetBIOS, **AT&T StarLAN**, **Novell NASI/NACS** and **TES**, **3COM BAPI**, and **TCP/IP** standards. **Kermit** has also added enhanced Tektronix graphics terminal emulation through **VT340** extension. **MS-DOS Kermit** retails for \$29.95. It is a product of the Columbia University Center for Computing Activities, New York, N.Y.; (212) 854-3703.

Lotus Freelance Plus Network Edition, Version 3.01—**Lotus Development Corp.**'s business graphics software now supports DOS-compatible networks. **Lotus Freelance Plus** operates under **IBM PC LAN Program 1.2** and **1.3**, **3Com 3+ Share 1.3**, **Novell's SFT NetWare 2.15** and **Banyan VINES 3.0** operating systems.

Freelance Plus 3.01 features file sharing capabilities including warning messages that indicate whether a file has been modified by another user since it was last accessed. Support of **Lotus 1-2-3's** file reservation scheme prevents having worksheet data changed by another user while importing or viewing spreadsheet files. **Freelance Plus 3.01's** LAN administration tools permit a network administrator to manage all **Lotus** products from a single menu screen. Additional network functionality includes the ability to share peripheral devices and store symbol libraries (clip art) on the network. The Server

CONTINUES ON PAGE 56

The one accounting decision that's easy on you as well as your wallet.

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Hardware Specifications: Requires PC/MS-DOS version 3.0 or higher with 640K of memory and a hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3 1/2" media optionally available. IBM is a registered trademark and Personal System/2 is a trademark of International Business Machines Corp. Not copy protected.

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Software

Computers, FCC Class A, Class B, and You — or When is it better to get a B than an A?

You need to know the difference between computers that meet the FCC class B radio frequency emissions standards and those that meet only the Class A standards.

Computers emit radio signals in their operation. Because these signals may cause interference to radio and television reception, the marketing and the use of computers is regulated by the Federal Communications Commission. Under federal rules, computer users are responsible for remedying interference, including interference in neighboring homes.

Computers certified by the FCC as meeting the Class B standard are less likely to cause interference to radio and TV reception than those that have been verified by the manufacturer or importer to the Class A standards. Only Class B certified computers may be advertised, sold, or leased for use in residences. A similar regulatory program applies in Canada.

Buyers seeking computers for use in homes (including offices at home) should shop for computers and peripherals which have been Class B certified. These devices carry a label with an FCC ID number. Both new and used Class A verified devices may be sold only for use in commercial and industrial locations. Signals from computers are more likely to be masked by electrical noise from other equipment in such an environment. These areas are also likely to have fewer radios and TVs. Accordingly, equipment marketed only for use in these locations may meet the less rigorous Class A standard. Class B certified equipment may be marketed for use in residences as well as commercial and industrial locations.

As you shop for a computer for use in your home, look for the FCC classification in the specifications or ask your vendor to recommend only machines that have been certified to the Class B limits. TV viewers and radio listeners in your home and in neighboring homes will be glad you did.

New & Improved

IMPROVED

CONTINUED FROM PAGE 54

Edition of *Freelance Plus* 3.01 retails for \$695, while the Node Edition costs \$395. *Freelance Plus* 2.0 and 2.01 users can upgrade to either the Standard or Node Editions for \$100. Lotus Development Corp., Cambridge, Mass.; (617) 577-8500.

DOS Partner, Version 1.1—The latest release of EasySoft's DOS shell software adds network and mouse support. *DOS Partner* 1.1 now recognizes up to 26 local or network drives for 3Com, Novell, and 10-NET LANs, and it supports Microsoft, Logitech, and compatible mice. A new disk drive management feature lets you view readable files one at a time, by directories, subdirectories, or folders. *DOS Partner* 1.1 displays files in their native formats, including *WordPerfect*, *WordStar*, *XyWrite*, and *Volkswriter* documents as well as *Lotus 1-2-3* and *Quattro* worksheets. *DOS Partner* 1.1 runs in 300K of RAM when active, or in 6K as a TSR when not loaded in memory. EasySoft's DOS shell retails for \$99. EasySoft Inc., Atlanta, Ga.; (800) 526-6201, (404) 992-4140.



DOS Partner's main menu takes the place of DOS for beginners. New features include file and drive management.

MultiBase, Version 3.0—Cykic Software's enhanced multiuser *dBASE* software now supports 30 dumb terminals running the same *dBASE* application off a single PC via a serial connection. *MultiBase* 3.0 also adds a capacity to daisy-chain additional users. Further enhancements include a memory manager that supports up to 16MB of extended memory, as well as additional *Clipper* functions including *ACHOICE*, *VALID*, arrays, and user-defined functions (UDFs). Cykic has optimized its disk manager for faster performance, and a new configuration utility aids in setting up your hardware. In addition, a basic multiuser system allows you to access all data files from any other connected PC. *MultiBase* 3.0 has also incorporated *PCTERM* terminal emulation. In addition to *dBASE III* and *IV*, *MultiBase* 3.0 supports *Clipper*, *FoxBASE+*, and other *dBASE*-compatible packages. *MultiBase* 3.0 retails for \$499, with a runtime version available for \$399. Cykic Software, San Diego, Calif.; (619) 297-0812.

CAD*A*LOG, Version 2.15—Orion Development's improved version of its CAD administrator's support utility now features improved user prompts and queues in the CAD batch file. In addition, the batch file supports automatic transfer of information from floppy diskettes to hard disk for faster performance, as well as automatic back-ups and improved security and log entries. Enhanced summary reporting supports six report types for productivity analysis. *CAD*A*LOG* also adds a 12-character job charge number and a 48-character drawing title descriptor. *CAD*A*LOG* retails for \$149 for single users. A single-site license is \$995, multiple site licenses are available for \$1,495. Orion Development Corp., Merrifield, Va.; (703) 698-8126.

35mm Express, Version 4.3—Business and Professional Software has added CGM file import capability to its presentation software. *35mm Express* directly supports CGM files without needing any file conversion utilities. *35mm Express* users can access CGM files directly from *Arts and Letters*, *Corel Draw!*, *Freelance*, *Harvard Graphics*, *Zenographics*, and Macintosh products including *MacDraw*, *PowerPoint*, and *More II*, then color, scale, manipulate the images, or merge them with other graphics. Additional improvements include a color PostScript output, a driver for IBM's LaserPrinter 4019, and a speaker's notes function to print graphic images three-per-page with labels indicating cabinet, folder, graphic title, and date of creation. *35mm Express*, Version 4.3 sells for \$495; upgrades are available for \$149.95. Business and Professional Software Inc., Cambridge, Mass.; (617) 491-3377.

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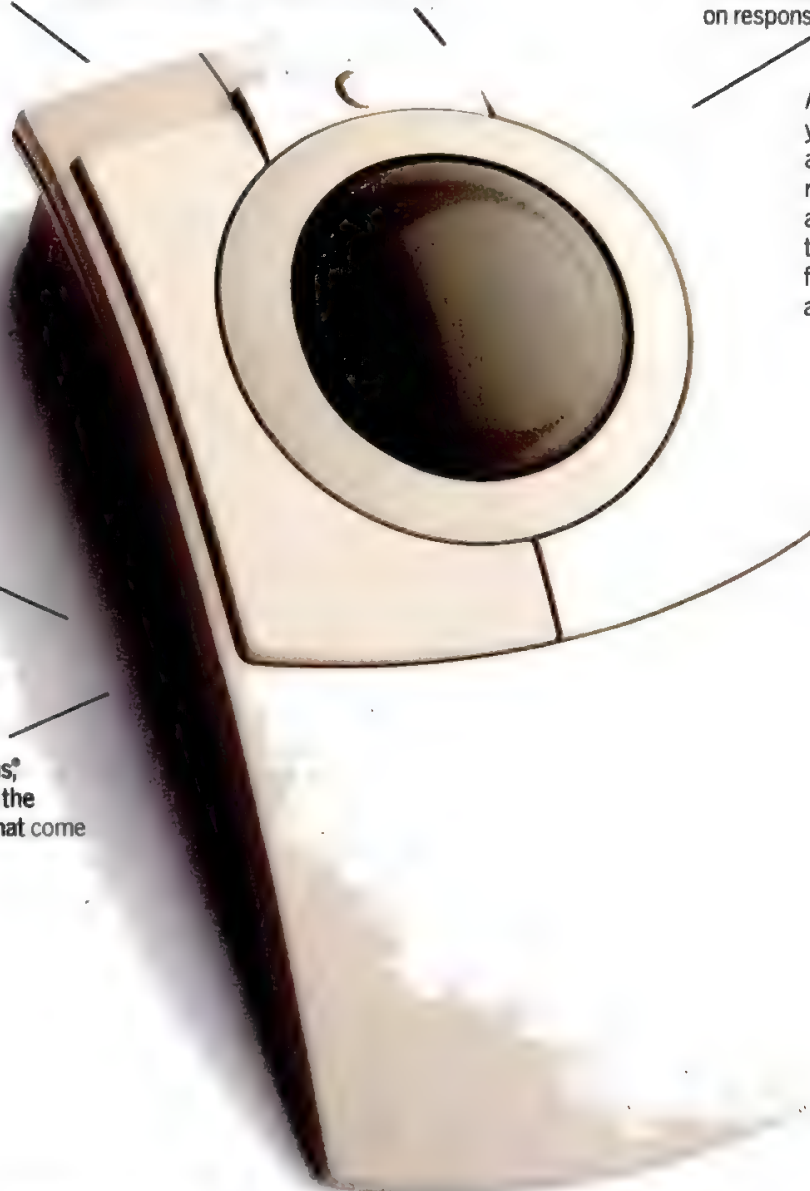
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New & Improved

Composa Compiles Symphony Spreadsheets

NEW

Composa from Sheng Labs lets users compile *Symphony* .WRI files into executable files that can run as standalone applications. *Composa* supports *Symphony* environments including Sheet, Form, Doc, and Comm, as well as the application's macro library, data matrix, and regression. In addition, *Composa* prints graphs and employs minimum recalculation to enhance performance.

An open-architecture product, *Composa* supports user-defined functions—in C or assembly language—incorporated within an application, and uses these functions within the compiled application. Additional customization features include the ability to create pull-down menus, set application title pages, and assign color combinations for each window. *Composa* supports expanded memory, hard-disk based virtual memory, and a math co-processor.

List Price: *Composa*, \$795. **Requires:** 512K RAM, and a hard disk. DOS 2.0 or later is recommended. Sheng Labs Inc., 4470 SW Hall St., #282, Beaverton, OR 97005; (503) 646-3691 or (800) 548-1270.

CIRCLE 438 ON READER SERVICE CARD

Carbon Copy AutoPilot Launches Remote Applications

NEW

Microcom Software Division's new companion product to its *Carbon Copy Plus* remote control PC communications package, *Carbon Copy AutoPilot*, automates application programs and creates custom screens with its comprehensive script language, panel manager, and text editor.

Carbon Copy AutoPilot's script language features a file transfer utility that can be used to automate other application programs from a remote source, including *Lotus 1-2-3* and *dBASE IV*. The script language also supports deleting and renaming files remotely, as well as creating new directories, launching remote applications, and executing custom scripts. ■

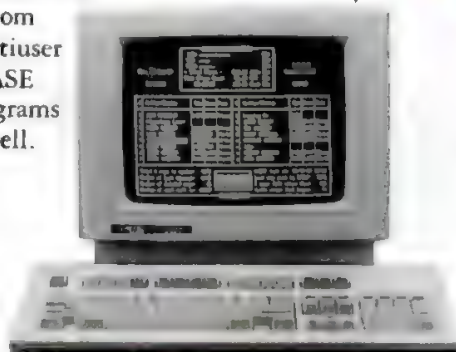
List Price: *Carbon Copy AutoPilot*, \$99. **Requires:** 512K RAM, *Carbon Copy Plus*, and a modem. DOS 2.0 or later. Microcom Software Division, 500 River Ridge Dr., Norwood, MA 02062; (617) 551-1000.

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Focus Groups	20-Aug-90	1.1		
Recommendations	24-Sep-90	0.8		
Specifications	4-Sep-90	2.3		
PRODUCT DEVELOPMENT	15-Nov-90	7.6		
Prototype	15-Nov-90	3		
Development	22-Feb-91	4		
Phase I	22-Feb-91	1.4		
Phase II	5-Apr-91	2.6		
Testing	29-Mar-91	3.8		
MANUFACTURING	12-Jun-91	3		
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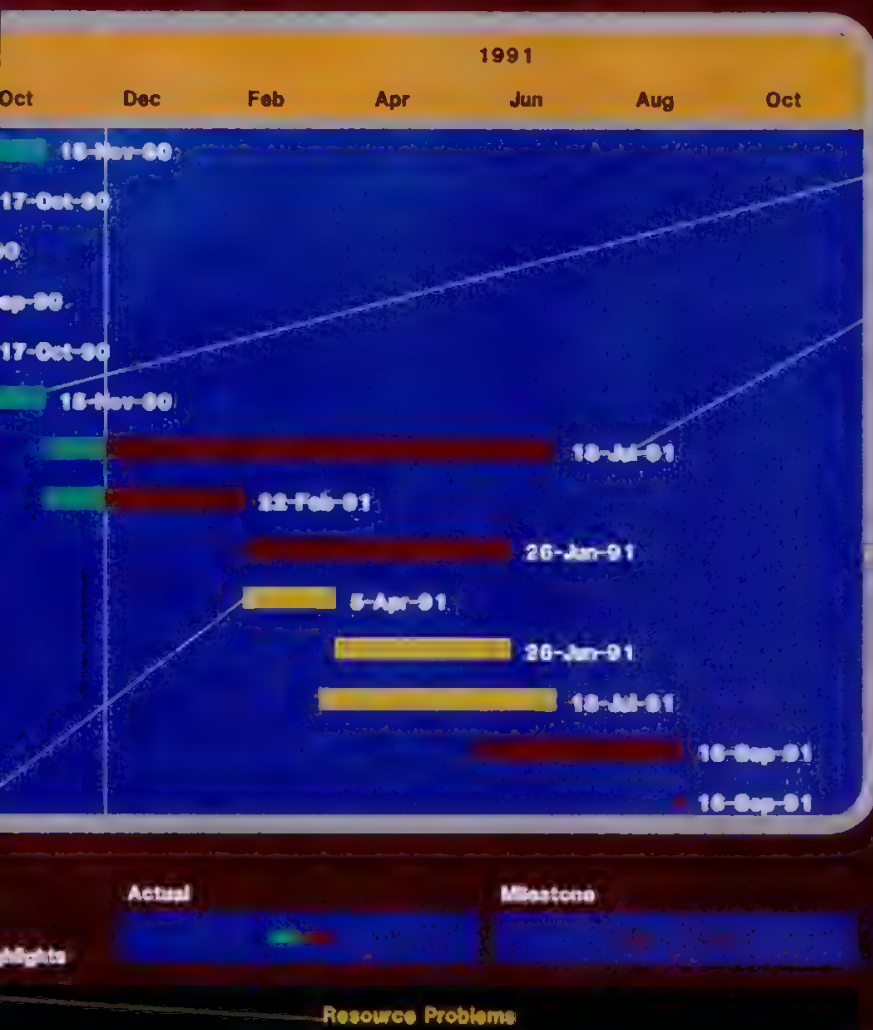
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*Time Line received PC Magazine's Editor's Choice Award in '86, '87, and '88. It is also the #1 best-selling project manager (Survey of National Distributors), and received InfoWorld, Software Digest, and PC Week's highest 1988 ratings for project management programs. Training and consulting services available, call 415/898-1919. Time Line and Project Presentations are trademarks of Symantec Corporation. © 1990 Symantec Corporation

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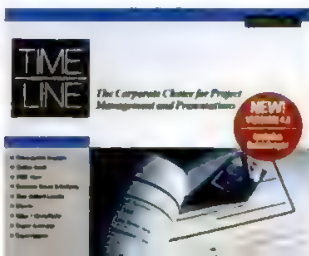
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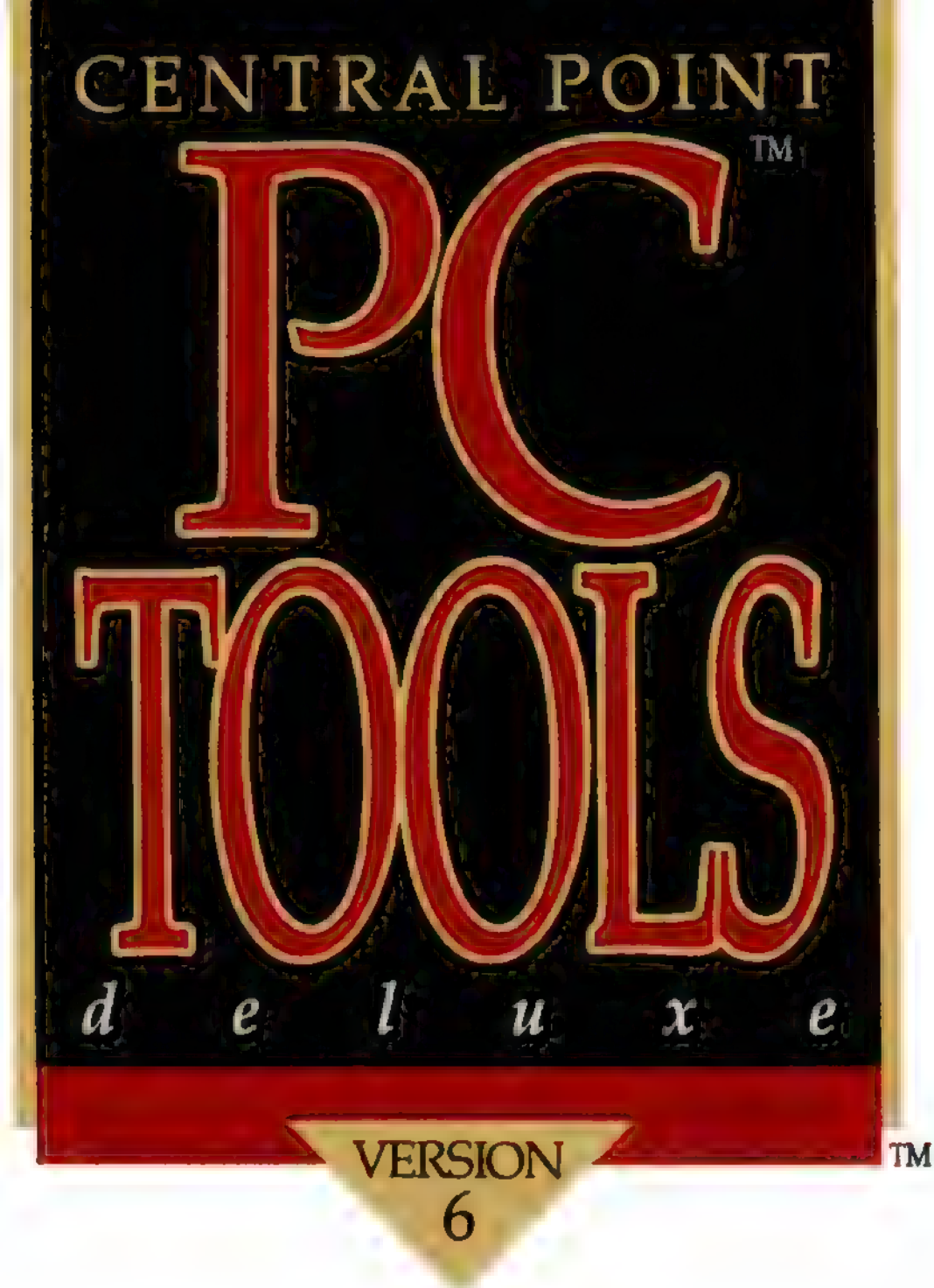
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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

More Life in a Laptop May Come from Lithium and Aerobic-Zinc Cells

How many watts can you squeeze from a battery? Not enough for most laptop users.

With low-power CMOS chips, tiny disks, and LCD panels in widespread production, building smaller and lighter laptops has become a straightforward matter of tinkering with these parts until they yield the best configuration. And the best configura-

tion has come to mean a computer with the lowest possible power draw.

The most stubborn barrier to building a better laptop at this time is the battery life. Attempts to squeeze more life out of today's best technology for rechargeable power—namely, nickel cadmium cells—are moving along at a pace that seems painfully

slow by today's standards. Nickel cadmium cells are yielding about 20 percent more power in the same size and weight every year.

Two to four hours is the typical battery-charge life for a disk-drive-equipped system during heavy use.

Nickel and cadmium are widely used for today's rechargeable batteries because the combination can provide the steady power discharge needed by sensitive components. Few other chemicals can be recharged to produce a high enough voltage and an absolutely steady discharge.

A handful of manufacturers have opted for lead-acid batteries, which are efficient and can provide a longer life than nickel cadmium cells (about twice as long) but most laptop makers have shied away because lead-acid simply adds too much weight to a portable PC. And it can't be packaged in a slim custom design the way nickel cadmium cells can.

Rechargeable lithium cells probably have the best potential for powering tomorrow's laptop machines, and while NEC's fall

CONTINUES ON PAGE 64

TOP TEN SELLERS — A Five-Week History

The growing popularity of 386 systems is demonstrated by Quarterdeck Office Systems' *QEMM/386*'s first appearance in the Top Ten list. *QEMM/386* and its 32-bit cousin, *DESQview 386*, have been consistently scoring among the top 30 programs, but neither has reached this high before. *Microsoft Windows/386* is also doing well; it's running just out of the money, ranking 19th and 20th for the past two weeks.

Quicken 3.0
Intuit

WordPerfect 5.1
WordPerfect Corp.

Lotus 1-2-3 2.2
Lotus Development Corp.

TurboTax
ChipSoft

Fastback Plus 2.0
Fifth Generation Systems

Norton Utilities,
Advanced Edition 4.5
Peter Norton Computing

PC Tools Deluxe 5.5
Central Point Software

Carbon Copy Plus
Microcom

Microsoft Works 2.0
Microsoft Corp.

QEMM/386 5.0
Quarterdeck
Office Systems

READING THE CHART

The Top Ten Sellers list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending February 17. The charts that appear to the left of each program name show how the program's sales ranked each week for the last five weeks. The hash marks at the bottom of each chart represent each of those five weeks, beginning with the week of January 15. Dramatic shifts in a particular program's ranking may be the results of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram-Micro D and PC Connection Inc.

Rankings are based on a net total of copies shipped; returns are subtracted from gross shipments.

Pipeline

CONTINUED FROM PAGE 63

'88 debut of one in the UltraLite seemed like an omen of good things to come, rechargeable lithium cells still have a number of problems that need to be addressed.

Although they can store twice as many watt-hours as a nickel cadmium cell of the same size, lithium cells are prone to providing an erratic discharge rate, potentially fluctuating up to 2.2 volts. And the government adds a massive bureaucratic obstacle by prohibiting any lithium battery greater than .5 grams on a U.S. airliner. NEC waded through the red tape to secure a waiver for the UltraLite, but it was the sort of exhaustive procedure that convinces most PC makers to try something else.

Also, supplies of rechargeable lithium cells are limited. Only one small company in British Columbia is now selling them commercially.

Still, lab tests for lithium are promising enough that a division of Matsushita is hoping to have a rechargeable lithium cell ready for mass production by the end of the year, a step that could tempt more laptop mak-

ers to include lithium in their new designs.

Matsushita is also pioneering nickel-hybrid rechargeables which, like lithium cells, have the potential of providing double the charge of a nickel cadmium cell.

Nickel hybrid cells discharge at the same voltage as nickel cadmium batteries, so there is a

placements for the Toshiba T1600, NEC ProSpeed 286, and Sharp 4521 that will power the laptops for four times longer than nickel cadmium cells. What's more, APS expects these replacements to weigh even less than the nickel cadmium originals.

The technique requires air circulation during the discharge, so

Zinc replacements will power laptops
for four times longer than nickel
cadmium cells and weigh less.

good chance they'll be offered as drop-in replacements. Before they become popular, however, Matsushita will have to prove that the cells' predilection for rapid self-discharging is solved. At least one laptop slated for a midyear introduction will be powered by nickel hybrids. Around the same time, batteries made from zinc-carbon will be replacing some of the nickel cadmium batteries already in current laptops.

Aerobic Power Systems in Georgia hopes to have zinc re-

placements for the Toshiba T1600, NEC ProSpeed 286, and Sharp 4521 that will power the laptops for four times longer than nickel cadmium cells. What's more, APS expects these replacements to weigh even less than the nickel cadmium originals.

Since nickel cadmium batteries wear out after 200 to 400 hours, or about 50 deep discharge cycles, if you're a regular laptop user, you're going to be needing

a replacement battery some day and it may turn out to be an aerobic zinc-carbon pack.

Hotter Than Expected 386 Chip Prompts Extra Shifts at Intel

In early February, a howl went up from a handful of PC makers that sent shock waves through Intel's management. Orders for 386 chips were being delayed and in some cases refused. Intel was selling all the 386 chips it was making, and computer makers wanted more.

As part of the solution, IBM finally exercised its right to fabricate 386 chips in its own plants. And to keep other vendors supplied, Intel added more shifts and delayed closing its aging Livermore, California, facility, which had been slated for conversion to 1.5-micron chip fabrication.

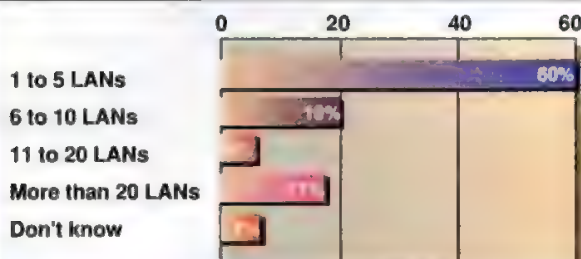
It wasn't enough to keep everyone happy; smaller vendors were put on allocation, based on their past purchases. Some companies are getting up to 30 percent fewer chips than they ordered last year.

With the increased production, Intel expects the problem to ease off by summer and to have everyone fully satisfied by the fall.

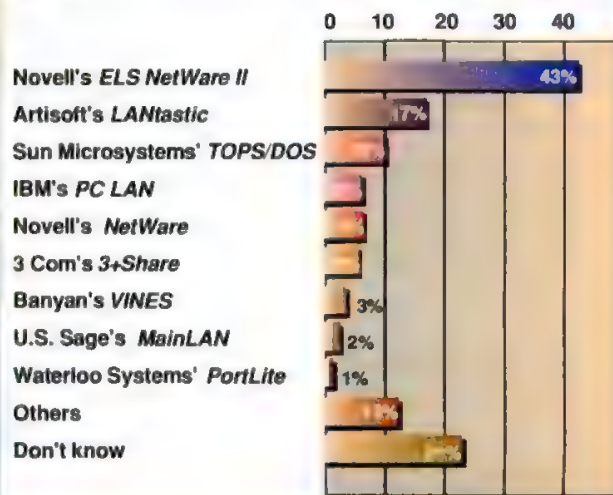
MAGNET SURVEY

Recent surveys of *PC Magazine* subscribers have revealed that 85 percent of the readers work in offices that use LANs. When we narrowed that down and asked callers to PC MagNet whether or not *small* LANs—which we defined as having between 2 and 10 nodes—were installed in their company, 57 percent said they were. Novell's strength in that market is clear from the charts below, but it's not quite as dominant in small LANs as it is in large LANs.

How many small PC LANs are in use at your entire organization in these categories?



Which network software are you considering for future small PC LAN use?



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CIRCLE 112 ON READER SERVICE CARD



Bill Machrone



A Unix workstation on the average business user's desktop is still an uncommon sight. But that doesn't mean that now isn't the right time to reevaluate Unix's place in the PC market.

"Are you going to buy any Unix-based systems this year?"

"Oh, sure. Maybe 15 percent of our 386s."

"Do you want us to write more about Unix?"

"Um, no thanks."

PC Magazine surveys its readers fairly often on their interests. The above exchange is a rough approximation of our results regarding Unix. It may be time for both of us to reconsider.

Big changes are afoot in the operating systems market as PCs move beyond the desktop and the workgroup into an enterprise-wide role. Unix and its applications have grown with the times. Most of the 386s installed with Unix are inexpensive alternatives for minicomputers. They have serial terminals attached to them and run straight multiuser applications. They're for keyboard touchers, not knowledge workers. An overclass of knowledge worker, the gold-collar worker, uses Unix, too. These are the people who know so much that no amount of hardware and software is too expensive if it increases their bandwidth or enhances their decision-making ability. They get high-end workstations.

In the great middle ground, however, the tool of choice is the PC, and the operating system is DOS. It's always made sense to the Unix fans to join hands across this wide gulf and bring Unix to the masses. It just never made sense to the masses.

Two products stand out as catalysts in increasing Unix's reach—one hardware, one software: Compaq's brilliant Systempro and Santa Cruz Operation's Unix implementation, SCO Xenix V Operating System. Briefly, the Systempro runs 3+*Open LAN Manager*, *NetWare/386*, and Unix equally well. In each case, it delivers essentially unsaturable performance, in which the number of users the machine can support becomes unimportant and the architecture or the size of your workgroup is the determining factor.

SCO is one of the old hands in the Unix marketplace and has, through its strategic alliance with Microsoft and canny adoption of emerging standards in the Unix arena, positioned itself extremely well. In fact, it has

emerged from the bitter wars among the Unix standard-bearers as the single best-positioned company—without having fired a shot. Not only has it addressed the performance issues of Unix as a file server but also the knottier problem of Unix as a user interface and operating environment through *Open Desktop*.

INSIDER FIGHTING

Just in case you haven't been paying attention, the last two years of Unix progress were marked by and marred by incredibly factional infighting between Sun and AT&T and the Open Systems Foundation, which represents virtually everyone else in the industry. The OSF proposed a windowing environment called Motif, which looks almost identical to Presentation Manager 1.2 and *Microsoft Windows 3.0*. The AT&T/Sun alliance proposed Open Look. A tour around the floor of the recent Uniforum trade show proved that OSF Motif was the winner and showed that the widest-distributed version of Motif was SCO's *Open Desktop*.



Open Desktop provides a rich graphical environment in which you can run applications written for it, DOS windows, X-Terminal windows, and ASCII terminal-emulating windows. It all multitasks merrily on 386 machines, hiding Unix's ugly face behind lovely full-color menus.

Some people are eager to position *Open Desktop* as an opponent to PM. I see them as

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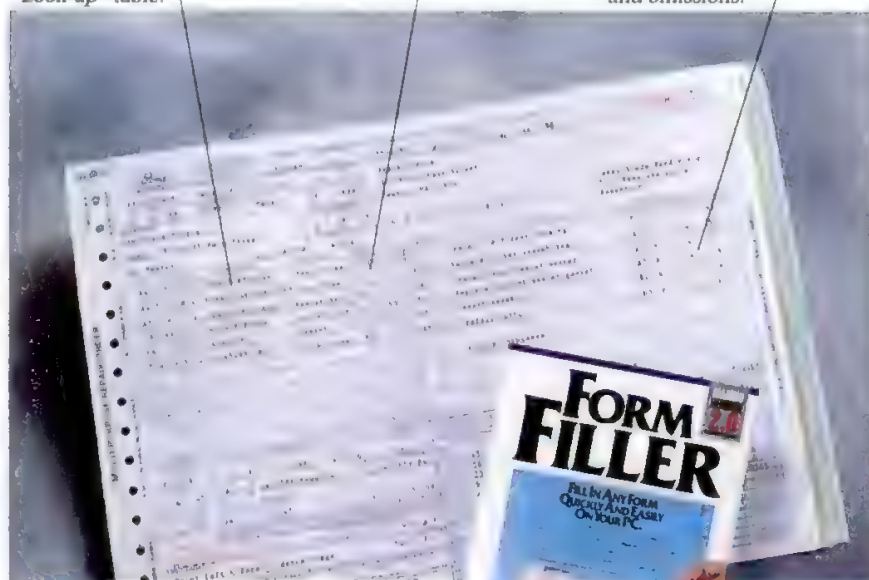
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Bill Machrone

complementary. Right now, Unix and OS/2 are split 50/50 for the non-DOS market. I expect that split to continue for some time to come. OS/2 is best positioned to extend the midrange knowledge worker's reach and power. *Open Desktop* is best positioned to work across multiple platforms with a consistent user interface.

SIMPLY ASTOUNDING

I saw something amazing the other day. It was a presentation from DEC in which the presenters never uttered the phrase "VMS." That's fascinating, given the enormous investment DEC has in its proprietary operating system, which runs on all of its machines. The ability to move customers up the ladder without so much as a recompile has been a powerful weapon and has made a shambles out of competitors' approaches, especially IBM's. The audience was a U.S. government agency, but DEC has been telling the same story everywhere. The topic was future computing platforms, but the focus was the multivendor environment. The government, of course, doesn't want to hear about VMS, since it's settled on a Unix standard.

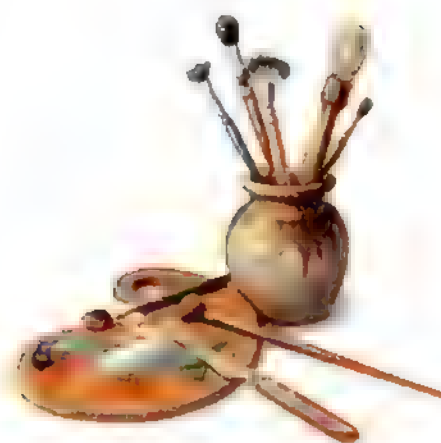
Open Desktop gives DEC a way to incorporate PCs into its continuum, with a seamless user interface all the way up the line. It's a graceful way to bring DEC's expertise in cross-platform connectivity and wide-area networking to the desktop.

The U.S. government has been a key player in the adoption and standardization of Unix. The huge new Desktop III contract specifies Unisys 386 machines and gives buyers the choice between DOS and SCO Xenix. The PC becomes the key to the future, a Unix-based Swiss Army knife that runs everything, including existing DOS applications, character-mode terminal applications, future X-Terminal applications, and future OSF Motif applications.

It's clear that no one vendor can do it all anymore. Even if they could, users don't necessarily want them to. Implementing systems is a constant balancing act among the installed base, the applications that work, the lure of new technology, and the sure promise of more cost-effective computing. Unix, all decked out in its shiny new Motif interface, will take its place in the panoply of viable choices. And SCO Xenix is its best exemplar. ■



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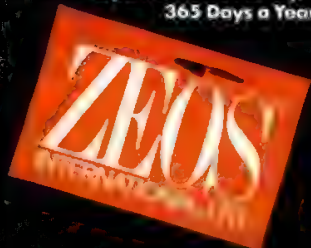
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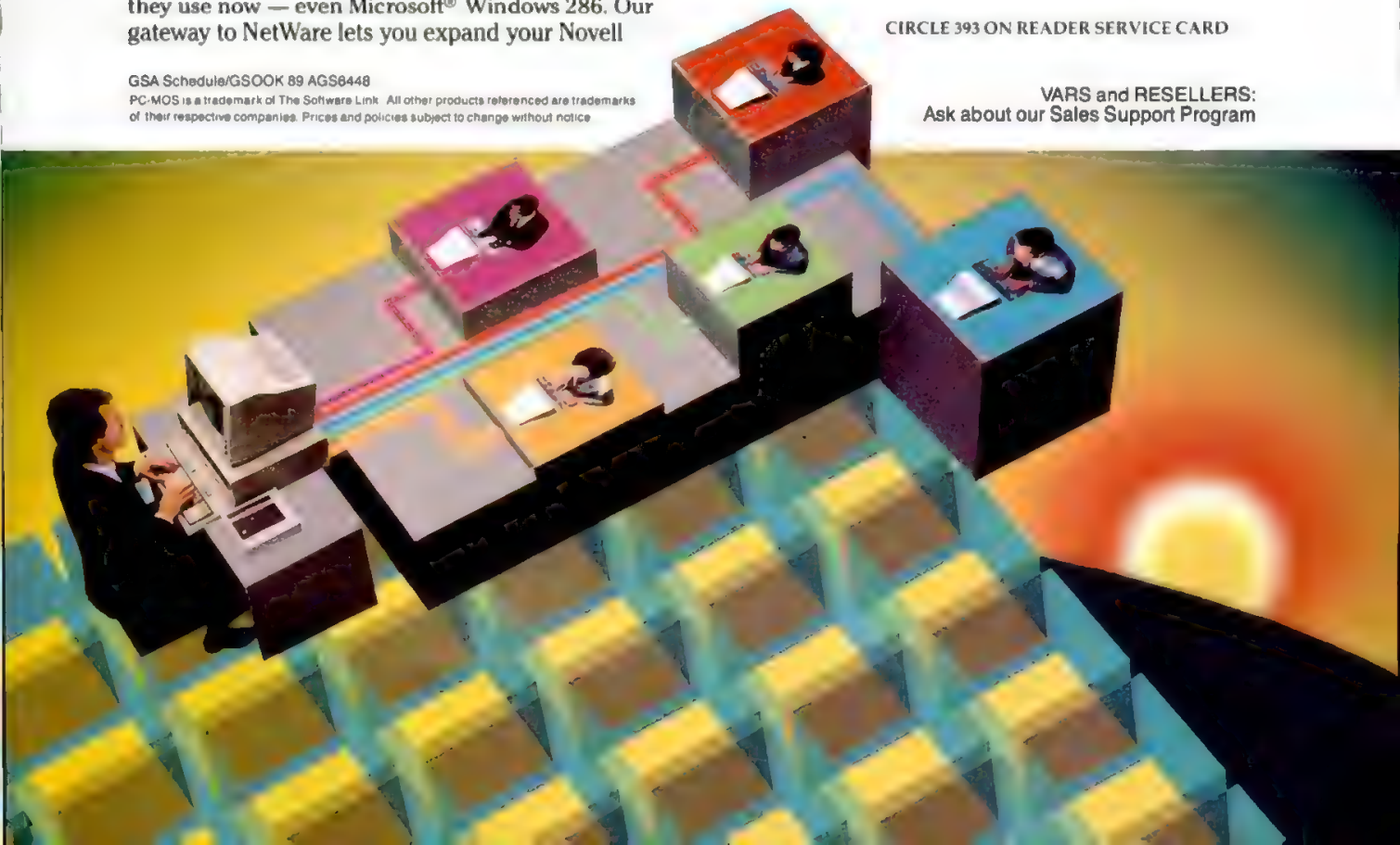
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John C. Dvorak



**If history really
does repeat itself,
then computer-
industry cycles will
parallel those of
other businesses.
But which ones?**

People are always trying to figure out what direction desktop computing will take by looking for businesses that are analogous to the computer business. Their hope is that the cycles of some older industry will match the ones we're seeing in this booming business.

Actually, three businesses—broadcasting, book publishing, and automobile manufacturing—and the ways they've been chronicled by the press—come to mind as bearing similarities to the computer industry. Indeed, it's possible that the computer business will assume the characteristics not of one but of *all* three.

Broadcasting first. As I mentioned long ago in this column, the early days of radio and TV were as faddish and noisy as today's computer scene. But much of that has faded over the last 80 years, with the result that there is only one major consumer magazine concerned exclusively with broadcasting—*TV Guide*, a mere listing of programs with some feature stories thrown in so you'll know it's a new issue. Of course, the computer industry will never need the same kind of journalism as TV, since PCs are not subject to a never-ending stream of new programming that lends itself to chronicling by list.

I think we can expect computer mania to last at least as long as broadcasting mania. If it started with the invention of the ENIAC in the late 1940s, then we still have 30 years to go. If it started with the invention of the microprocessor, then it looks as if our joyride won't be over until 2050!

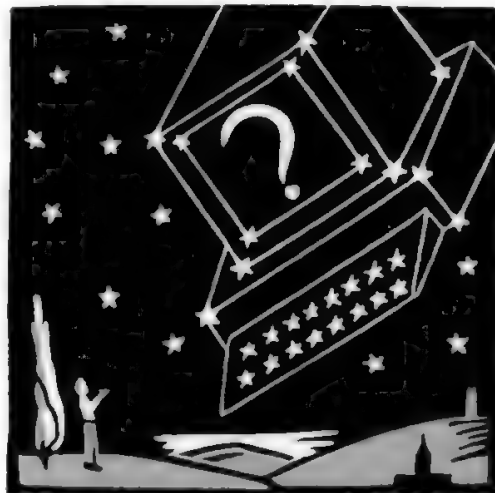
In the meantime, book publishing has stabilized as an important aspect of society. Books are pure software—the ultimate random access devices—but of a different style. This form of software is so important to our culture that book retailing—like software retailing—is still a booming business, despite the current talk about illiteracy, cultural or otherwise.

Will *The New York Times*, which devotes a section of its Sunday edition solely to reviewing newly published books, ever dedicate a similar amount of space to reviews of newly published software? We may see some encroachment, but on the whole probably not, since information technology doesn't model itself after the print medium but rather com-

petes with it. Books and software are intellectually engaging random access devices, but they've taken different evolutionary paths; the former began as a means for distributing information and the latter as a means for speeding calculations. The parallels between the two are best looked for in the retail channel.

The automobile model looks better and better as a means of shedding light on the direction and function of special-interest magazines and newspapers. Cars, like computers, are big-ticket items that attract enthusiasts—and enthusiast magazines. While I really don't see anything quite like *PC Magazine* in the auto world, I suspect that if enthusiasm for cars and PCs had been coeval, the *PC Magazine* model would have been swiftly appropriated. Somebody blew it.

So, we have a little of everything in today's computer scene. We can go crazy drawing parallels, but we'll see the big picture if we narrow the parallels down to four. What conclusions can we draw from the commonali-



ties? Most important, these businesses *all* consolidated near the end of their life cycle. Second, they all lasted a lot longer than anyone suspected and retained their popular interest. Count the tremendous number of automobile magazines on the rack and compare that to the still growing number of computer magazines. Third, they made a lot of people rich and captured the imagination of the public. Fourth, these businesses are all a lot of fun.

You don't have to be a rocket scientist to program in BASIC.



Granted, with Microsoft's BASIC Professional Development System, rocket scientists can work wonders every day of the week.

But if you want to work better in this stratosphere, Microsoft® QuickBASIC is all you need.

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Naturally, this BASIC also turns out code at record speed — 150,000 lines per minute.

Not surprisingly, *PC Magazine* called it "... perhaps one of the greatest software programs ever written" and gave it their Editor's Choice Award.

All of which only goes to prove one thing: you don't have to be a rocket scientist to conquer new frontiers.

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Recently, *PC Week* reported a **surge** in sales and a consequent shortage of the 25-MHz 386 microprocessor. On top of that, I'm told that interest in the **386SX** has **skyrocketed**. (Expect to see a slew of portables and laptops using it.) I guess that the Intel billboard campaign promoting the 386SX is paying off. One source tells me that **IBM is buying 386SX chips by the carload** for some unknown reason and has quickly passed Compaq as the principal customer for the chip. What does this all mean? Probably higher prices for a few weeks.

Keeping Up with the Joneses Dept.:

One of the best-kept secrets in the computer business is a voluminous Asian trade magazine called *Computer Products*, which covers the computer scene in Taiwan, Hong Kong, and Singapore. Almost every maker of every **obscure** part and every elusive machine (laptops included) is listed or advertises in this massive magazine. It's better (and cheaper!) than taking a trip to Taipei. I find it fascinating to thumb through. If you love **vicarious window shopping**, or if you are interested in getting into the computer business, you have to subscribe. There is a corresponding magazine from the same publishers for general electronics (video games, stereo gear, and so on), jewelry and fashion accessories, as well as other export items. It's available through Wordwright Enterprises Inc., 1020 Church St., Evanston, IL 60201; (708) 475-1900. *Computer Products Magazine* is \$60 a year by surface mail, \$220 airmail.

Idea of the Year Dept.: One of the best concepts I've seen this year is the UPS (uninterruptible power supply) on-a-card from Emerson Electric Co. Looking kind of like a Plus Hardcard, it's actually a **small UPS** that plugs into your system. When the power fails, the card triggers some software that saves the state of the machine onto a hard disk file and powers down. When power comes back the machine is right back where it was, **as if nothing had happened**. While, unlike a typical UPS, it doesn't let you continue computing for another half hour or so, the advantage is that it's automatic and **costs only \$250!** Sounds like cheap insurance to me. Nice! Available at many computer stores. Call Emerson for the dealer nearest you.

Genuinely Interesting Software Dept.: This may be the finest piece of word processing code **ever written**. I have never been as **impressed** with anything as I have with **VDE 1.5**. It was coded by the talented Eric Meyer in Norman, Oklahoma. More than a *WordStar* clone, this is a **full-blown word processor** utilizing *WordStar* commands with windowing, undo, justification, programmable function keys, auto-save, macro capability, 43/50-line toggle, *WordPerfect*

Inside Track

compatibility, *WordStar* 3, 4, and 5 compatibility, **blazing speed**, and more.

Fully loaded, the code size is just over 40K—proof that writing software in **100 percent assembly language** still pays off in performance and reduced code size. It's an **astounding** product, believe me. It's more than the perfect laptop word processor. Actually, it's something that corporations should consider if they want to **save tens of thousands of dollars**.

Now that the Software Publishing Association is **dogging**

large corporations and trying to get employees to **fink on their bosses** if a bootleg copy of some software is present, it's time everyone went legit. **VDE is free** to individuals and sold in the form of site licenses for corporations. Twenty desktops for \$50. For larger sites it's even cheaper per desktop. Meyer works with large accounts as a paid consultant to install special printer drivers or whatever a company needs. Call him at (405) 329-5777 if you need multiple copies. He **does not** want to be called for single copies, by the way, preferring to let disk libraries and user groups distribute the program. Smart corporate micro managers

should consider the possibilities.

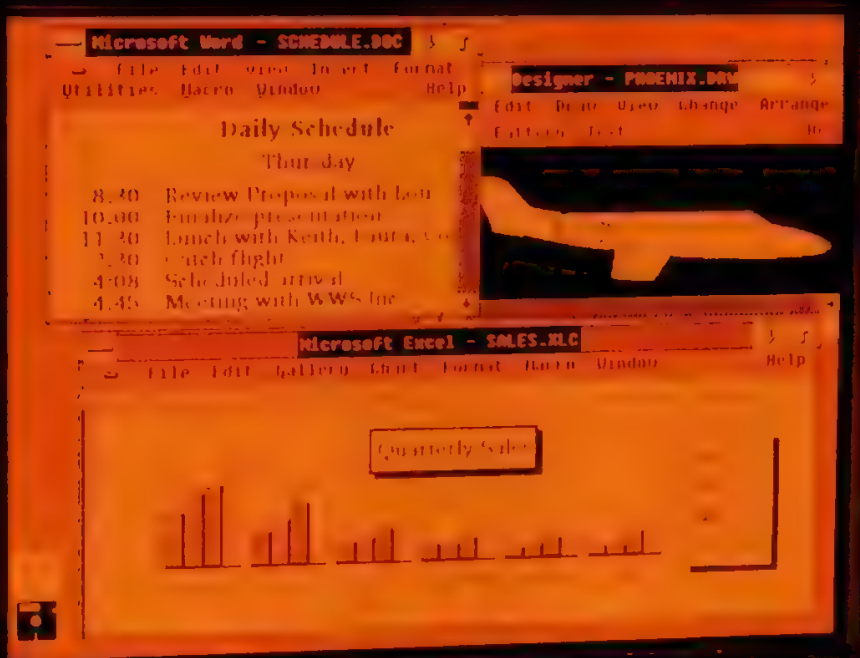
One company bonus: individual users can use the software free of charge. This means employees can take the system home without worrying about **corporate piracy** concerns.

The use of quality **alternative software** by large institutions is not new. *The Los Angeles Times* uses *PC-Write* exclusively. It's on all the reporters' desktop machines and remote laptop computers.

Copies of **VDE 1.5** are available from most libraries and user groups that carry public-domain software and shareware. By **special arrangement**, one of these, California Freeware in Palmdale, California, will ship unarchived copies of **VDE 1.5** for \$4.99 including shipping and handling to readers of *Inside Track*. Call (804) 273-0300. You can also download free copies from the **CompuServe/PC MagNet** Dvorak library (LIB 6). You need ARC-E or PKUNZIP to unARC or unZIP the appropriate file into its components. Go into the PC MagNet editorial forum, then into the libraries. The documentation is on an included disk file. I cannot give a higher recommendation for any product that I have seen in **ten years** than I can for **VDE 1.5. Top recommendation.**

Anecdote of the Month Dept.: I went to the East Tennessee PC Users Group in Knoxville to give a talk. One of the Users Group officers mentioned to me that although the ETPCUG is large (as witnessed by an auditorium full of well-wishers), the group's officers were all "drafted." Apparently **nobody ever volunteers in Tennessee**. As many of you know, Tennessee is nicknamed the Volunteer State! ■

**VDE 1.5 may be
the finest piece of
word processing
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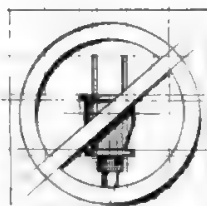
Next, we devised an ingenious display system unlike anything you've ever seen on a battery-powered portable. It combines both VGA and gas plasma technology, boasts a 100:1 contrast ratio and can support both an internal display and an external monitor simultaneously.

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So now you can put the latest 386 computing power to work for you, even if there isn't a plug anywhere in sight.

The Toshiba T3100SX. Take it. See how far you can go.

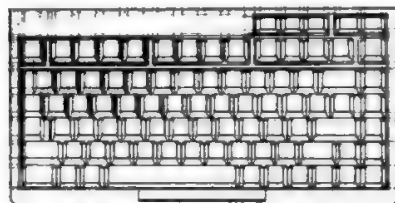
T3100SX: 14.9 pounds, 16MHz 386SX with 80387SX math coprocessor socket; 40MB hard disk with 25msec access, two removable, rechargeable batteries; three dedicated Toshiba memory slots, one dedicated Toshiba modem slot, one Toshiba general purpose slot; 1MB RAM expandable to 13MB, gas plasma VGA display with 16 gray scales and 100:1 contrast ratio; 1.44MB 3½" diskette drive. For more information call 1-800-457-7777.



Since the T3100SX is battery operated, you can utilize powerful 386 applications anywhere you choose.



The T3100SX's slim case is only 3.15 inches thick and weighs just 14.9 pounds including its two standard batteries.



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CIRCLE 379 ON READER SERVICE CARD



ACMA offers "...performance, expansion possibilities, better-than-average warranty, and reasonable prices. This is an impressive machine." "...our favorite is the ACMA 386/25 Business System." PC Magazine 11-28-89

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CIRCLE 129 ON READER SERVICE CARD

Jim Seymour



Until vendors give users what they really want and eliminate the sometimes small, always frustrating problems of computing, everyone's a loser.

Is the pace of developing technology outstripping our ability to implement, deliver, and support that technology? Or are the business structures in place in the PC industry simply insufficient to meet the needs of customers?

I wish I knew. Wherever the faults lie, we'd better fix them soon. Because it's getting harder and harder to get new hardware and software installed and its users productive.

I spend a lot of time on the phone, talking to PC software and hardware support people. It's not that I'm especially chatty, or that the programs I use are particularly buggy. Over the course of a year I install, learn, and use (at least for awhile) more new products than most PC users do in a lifetime, with the inevitable result that I spend a lot of time learning whose support services are good and not so good.

I almost always conceal my identity, so I don't get special treatment. But the results often make me wish I *had* tried to get V.I.P. treatment. And that makes me wonder where this business has gone wrong.

LITTLE HORROR STORIES

Item: I recently spent two hours on the phone with a tech-support person for a graphics-card vendor, trying to figure why its card wouldn't work in my PC. After a morning on my own, followed by two frustrating hours on the phone, we discovered the company was packing, with this new card, a disk with drivers for *another* card—but *labeling* the disk as if it were the one for my card. Because the file-names for the two sets of drivers were the same, we made the discovery by chance, by comparing file-creation dates.

Item: Last week I spent two days wrestling with a *PageMaker* file that wouldn't print properly on a genuine Adobe-licensed PostScript printer. After an incredibly patient Aldus tech-support person and I had nearly given up, I discovered the problem was a flawed PostScript printer-driver—which is *still* being shipped by the laser-printer maker.

Item: Last year many of us fell in love with NEC's glorious UltraLite. Unfortunately, bad manufacturing planning meant the ROM program cards for the Ultralite didn't appear on

the market till almost a year after the machine did. And worse, by the time NEC was shipping the *Microsoft Works* v. 1.05 ROM card, Microsoft was already shipping *Works* 2.0 on disk.

Item: Last January I spent a couple of days with a large corporate client, wringing problems out of a new high-end word processing program the company wanted to adopt as its standard. Only after lots of blood and tears had been spilled trying to get an important feature in the program to work correctly did a support person at the vendor call us back to say he was sorry: he'd just talked to the programmers, from whom he learned that the manual was wrong—the code had been changed shortly before the product had shipped, but they'd forgotten to write an addendum or a README file with those changes! And of course they didn't tell their telephone-support staff, either.



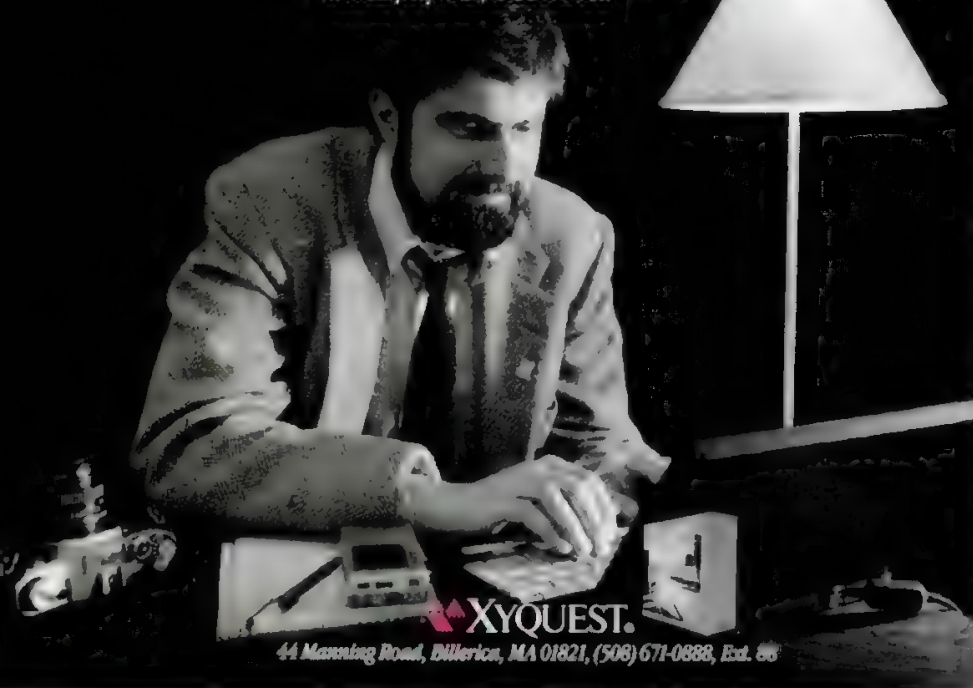
This isn't a harangue against rude or badly trained phone-support people. In fact, as in that last episode, the support people were as much victims of the system as I was.

In my experience, the quality of telephone support from most vendors has gone up dramatically over the last two years. And I find the level of training and courtesy among tech support people much better today than in years past.

We're also seeing encouraging new support initiatives, like 24-hour-a-day phone sup-

"XyWrite speaks ASCII"

London, Bangkok, Stockholm. Wherever I am, my editor gets the story by modem just the way I wrote it. That same ASCII file goes to the typesetter. No embedded codes. No conversion necessary. XyWrite, clean and fast.



XYQUEST.
44 Manning Road, Billerica, MA 01821, (508) 671-0888, Ext. 88

CIRCLE 518 ON READER SERVICE CARD

Jim Seymour

port, which indicate the people who manage the support function are listening to what users want.

Rather, this is a lament that product development and after-sale support are so far out of sync today.

It's easy to say those companies in my little horror stories above are exceptions, or that fringe outfits like that deserve to pay the price for their lapses. But those incidents weren't exceptions, but common events. Those *weren't* fringe vendors, but big companies. And note that they didn't pay the price—we did.

CREEPING FEATURITIS

"Creeping featuritis" is part of the problem. Today both hardware and software companies can graft new functions onto new and newly revised products faster than they can write manuals that correctly describe those functions.

Greater complexity in the products we use is part of the problem, too. Note that this isn't the same thing as creeping featuritis: many new programs I see don't do more, in a meaningful way, than the products they are intended to compete with or replace; they're just more complicated to use.

And the rush to market is *always* a problem: every company wants to be first with the newest, and that disease isn't limited to the PC industry. Just ask those Toyota Lexus owners whose swell new cars were quickly recalled a few months ago: selling new-technology products not yet ready for prime time is a universal problem.

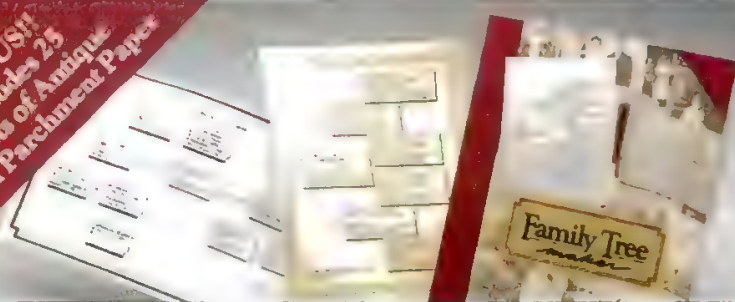
The real problem, I insist, is that vendors' perception of the relative values of their products as raw technology, and the value of those products as *answers* to users' needs, have gotten badly out of sync.

I've often said that support is literally inseparable from the product: you can't talk about them as if they're different things. What good is a product a typical user can't get working correctly?

Today that artificial division has become all too apparent. The business side of the PC business too often focuses on product development and ignores what customers say they really need.

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William F. Zachmann



IBM's AD/Cycle has attracted attention from people who are eager to enter the world of object-oriented programming. But will more modest tools do the trick just as well or better?

The term "object-oriented" has become for the software industry something like what "oat bran" is for the cereal industry. Just about everybody's jumping on the bandwagon, claiming they've got an objected-oriented something or other in their software products.

If you suspect there's an awful lot of hype in all this, you're right. Many of the claims made under the object-oriented banner are well out of proportion to what is really being delivered by the products. Still, with all that horse manure, there's got to be a pony in there someplace.

Finding the pony won't be easy for those who naively accept the notion that just because a software product is object-oriented, it is worth buying and using. Needless to say, the key to getting value from object-oriented software lies in isolating the benefits that the products can deliver rather than buying into the marketing hype that's used to sell them.

Contrast IBM's grandiose agglomeration of products collected together under the name of *AD/Cycle* and its related Data Repository against the much more modest collection of software tools from The Whitewater Group.

Despite the seeming impressiveness of the *AD/Cycle* collection, the pony in that particular region of the barn is likely to be very difficult to find. What's more, the search is likely to be a very expensive one. On the other hand, Whitewater's *Actor 2.0*, *Resource Toolkit for Windows*, and *WinTrieve* deliver benefits that any organization planning to use *Microsoft Windows* or the OS/2 Presentation Manager can ill afford to do without.

MIRED IN COMPLEXITY

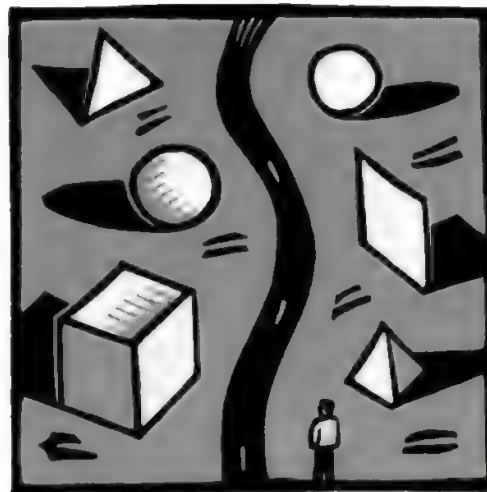
AD/Cycle is anchored to the idea of a central Data Repository influenced by entity-relation object models. The Data Repository is meant to be a sort of super directory to all the information stored throughout the enterprise.

Surrounded by a diverse and imperfectly integrated collection of software tools from IBM and other vendors (including a number of vendors in which IBM has made equity investments), *AD/Cycle* is being promoted as a technique that organizations ought to adopt as a way of developing software in the '90s.

Accurately evaluating whether or not it makes sense to adopt this technique is virtually impossible. The whole package is so diverse and so complex that it's difficult even to figure out what it is, let alone assess its virtues. We're simply supposed to be happy that it involves object-oriented and software engineering techniques, send our system programmers off to IBM school to learn how to use it, and pay huge software rental fees forever.

What *AD/Cycle* amounts to, however, is the traditional, bureaucratic approach to large-scale software development thinly overlaid with catchy new ideas. It isn't even new wine in old bottles. It's old wine in old bottles with new labels on them. And not particularly good wine, at that.

Even so, there still may be a pony in there somewhere. But those who want to find it are well advised to buy warily. Otherwise, they will find themselves burdened with an expensive collection of software that merely adds to



their information systems overhead instead of solving software development problems.

ON TARGET

While lacking the grand ambition and scope of IBM's *AD/Cycle*, Whitewater's *Actor* contains tremendously useful tools for building information systems. That it is also one of the most sophisticated object-oriented development systems yet to appear as a packaged product,

William F. Zachmann

while important, is a secondary issue.

Whereas *AD/Cycle* is a diffuse assembly of diverse elements only loosely integrated with one another, *Actor* has a clear underlying unity. Targeted specifically at software development for *Microsoft Windows* and the *OS/2 Presentation Manager*,

it acts like a well-aimed rifle as opposed to *AD/Cycle*'s pellet-spraying shotgun. Together with Whitewater's *WinTrieve* and *Resource Toolkit* packages, *Actor* makes *Windows* and *PM* software development possible for any organization.

DEPARTING FROM TRADITION

For several reasons, programming for a graphical user interface (GUI) like *Windows* or *PM* is considerably more com-

plex than the kind of ordinary business programming familiar to most organizations. First, *COBOL*, the programming language most widely used for in-house development by businesses, is not very readily adapted to GUI programming. More typically, *Windows* or *PM* applications are developed in *C*, *Pascal*, or assembly language.

Second, like the Apple Macintosh, *Windows* and *PM* require a very different programming model than that found in traditional business programming. The message-driven model common to these three GUI environments is a major departure from the standard procedure path familiar to most programmers.

The final and most important reason is that the application program interfaces (APIs) for *Windows* and *PM* are more complex than anything most business application programmers have ever had to deal with. They are even more complex than the collection of I/O and supervisor macro instructions and services that systems programmers in the IBM mainframe software environment must address.

The *Windows* API contains several hundred—and the *OS/2 PM* API nearly a thousand—separate subroutine calls, each with its own parameters, options, and return codes. It can take a first-rate *C* programmer six months or more just to learn the *Windows* or *PM* API calls well enough to become proficient in their use. For a typical *COBOL* programmer, it's a long leap to programming for *Windows* or *PM*, requiring at minimum a full year of training and practice.

Enter *Actor*. It has the power to turn the extremely complex *Windows* or *PM* API into a rather simple, structured collection of understandable objects that can readily be manipulated by any reasonably capable programmer. Its functional complexity is not much greater than that found in a macro language typical of a modern PC-based spreadsheet or word processing package. As a result, capable business programmers can develop applications for *Windows* or *PM* in a matter of weeks rather than months or even years.

For that reason, *Actor* is likely to have a far more profound impact on information systems development for businesses in the early '90s than will IBM's much more ambitious *AD/Cycle*. Companies using *Actor* will already be reaping the benefits of object-oriented software, while those banking on *AD/Cycle* will still be looking for the pony. ■



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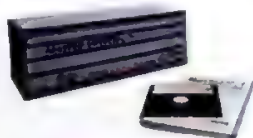
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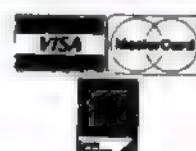
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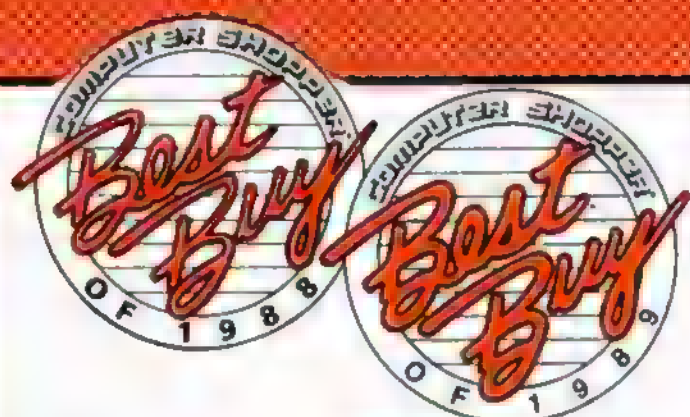
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Bios	ERSO	Phoenix	AMI	Phoenix	Phoenix
Norton SI Rating	2.1	13.4	19.01	23.0	30.5
Wait State	0	0	0	0	0
Standard Memory	640K	1 MB	1 MB	1 MB	1 MB
Shadow Memory	-	-	-	64 K	64 K
Cache Memory	-	-	-	32 K	32K
Co-Processor Slot	Yes	Yes	Yes	Yes	Yes
Expansion Slots (8 bit)	8	2	2	2	2
Expansion Slots (16 bit)	-	6	6	5	5
Expansion Slt (32 bit)	-	-	-	1	1
FD/HD Controller	W/HD	Yes	Yes	Yes	Yes
Device Bays	4	3	3	5	5
Serial Ports	-	2	2	2	2
Parallel Ports	-	1	1	1	1
Game Port	-	1	1	1	1
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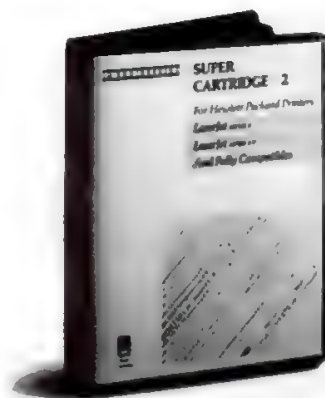
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CIRCLE 325 ON READER SERVICE CARD

Stephen Manes



**Think your computer
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Astronomers occasionally have celestial bodies named for them; rarely do they become stars in their own right. But the ads that claim "You've seen him in *People Magazine*, on 'Good Morning America,' and on 'Saturday Night with Connie Chung'" do not refer to Donald Trump, Sean Penn, or any of the other celebrities responsible for the premature failure of so many channel-switch buttons. They refer to Clifford Stoll, professional astronomer, top-notch programmer, savvy yo-yoist, and author of *The Cuckoo's Egg* (Doubleday, \$19.95). Subtitled "Tracking a Spy Through the Maze of Computer Espionage," this true-detective tale has dazzled even such unlikely sources as *Cosmopolitan*, which the ads quote as saying that the book will "grip" you "even if you don't know a byte from a bagel."

But if you do know better than to garnish your bytes with cream cheese and lox, don't hold the media hype against Stoll. When I spotted him on C-SPAN at five one jet-lagged morning, the guy seemed slightly bemused by all the attention, and his interviewer didn't know what to make of him. On TV, Stoll came off as a brilliant naif, one of those slightly off-key geniuses by no means uncommon in real life but somehow excluded from televised reality. In the book there's more brilliance and less naivete.

Stoll's celebrity could conceivably divert attention from his book to his personality. That would be a shame. Even if you don't count his recipe for chocolate chip cookies, *The Cuckoo's Egg* is essential reading for anybody who works with computers.

It's also painless reading—a detective yarn with a spellbinding plot. In his first few days as manager of a Berkeley computer system, Stoll finds a 75-cent discrepancy in user billing. He soon discovers that an unauthorized outsider has been accessing the system. With the help of a second machine—a decrepit PC—and a bunch of printers so ancient that their owners trade them for cookies, Stoll begins monitoring the intruder's electronic incursions.

The situation turns out to be even worse than it looks. The interloper has managed to give himself privileged access to the entire system. He has cleverly swiped a variety of

passwords. And he's connecting through Stoll's machines to a nationwide assortment of systems having to do with military and space matters. From then on, it's a cat-and-mouse game as Stoll works to trace the intruder back through the phone lines, keeping the target systems safe from depredations and at the same time trying not to tip off the marauder that he's being watched.

CIA JARGON

Stoll's writing is clear and suspenseful, with a flair for detail. In keeping with his training as an astronomer, Stoll tells us, he kept a detailed log of events. It shows: he reveals the particulars of everything from the rites of Halloween in San Francisco to the peculiar jargon of CIA operatives.

Stoll unfolds his tale from his own point of view, and this personal element is crucial. As a Berkeley anything-but-conservative, he's surprised to find himself cooperating with the



CIA and FBI and even wishing that they would be more helpful. He's chagrined at the havoc his quest for the hacker wreaks in his personal life, forcing him first to sleep in the lab and then live at the beck of a pocket pager rigged to his hacker-catchers.

You marvel at Stoll's cleverness at figuring out—from the transmission delay between responses within the hacker's Kermit file-transfer protocol—roughly where the hacker

Stephen Manes

should be; then you smile sympathetically at his reluctance to give the data its most obvious interpretation. You wonder along with Stoll why a hacker would bother stealing files of encrypted passwords when the encryption algorithm was guaranteed irreversible—and then shake your head when he reveals the simple brute-force process that makes deciphering them almost trivial. And you're likely to be as surprised as he is at the tenuous but real connection between his case and the one involving the virus developed by Cornell student Robert Morris.

Stoll explains many of the specific holes in the systems he monitored—many of them utter howlers. Bugs in the Unix text editors Gnu-Emacs and VI let users move files into the supposedly protected system areas. A Unix mail program blithely allowed users to enter a debug mode that could give them total control. Another Unix program mindlessly interpreted excess characters as system commands. And anyone who managed to wander into a suppos-

edly secure DEC VAX computer could run a short program to bestow full system-manager privileges upon himself.

If simple access is all you want, however, you don't even need software bugs; a lax or inept system administrator will do fine. In one case, the hacker signs on with the user name "field" and the password "service." Systems software often comes with built-in standard "backdoor" passwords; system administrators often forget to delete them. Bingo.

NO APOLOGIES

Stoll brings a great deal of sheer moral outrage to the case in particular and the issue of computer security in general. His rationale for devoting so much time to it boils down to the fact that the hacker is a thief: stealing computer time and snooping in the private files of hundreds of users. Stoll holds no truck with the apologists for the "harmless" virus that Robert Morris unleashed on some 2,000 computers; he likens the stunt to letting the air out of the tires of 2,000 cars.

Stoll does discuss how hacking, frivolous and otherwise, poisons the spirit of community, forcing people to put locks

on doors that had otherwise remained open. But with so much emphasis on the specifics, he touches the larger issues only briefly. And there are plenty. Take system integrity: the initial purpose of Stoll's surveillance was to find out what the hacker was doing to the systems he hit. Were logic bombs and viruses planted? Were files affected? As it turned out, the answers were no and no, but once a single unauthorized user manages to gain access to any file on the system, there's no definitive way to tell how or if the system has been otherwise compromised.

The basic question of security—are your files and programs safe from intrusion?—is just the first of a Pandora's trunkful. Privacy (can the ambitious jerk at the next desk read your files?) is another; integrity (can that jerk forge nasty memos under your name?), one more.

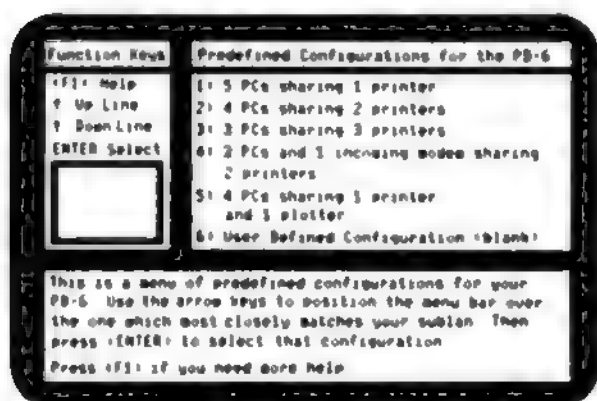
The list goes on and on. But most of us prefer to respond as one defense contractor did after Stoll discovered someone fooling around in its system: "We're running a secure shop around here and nobody can break in."

As the then-unknown astronomer said to himself: Right. ■

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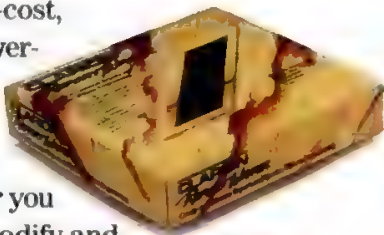
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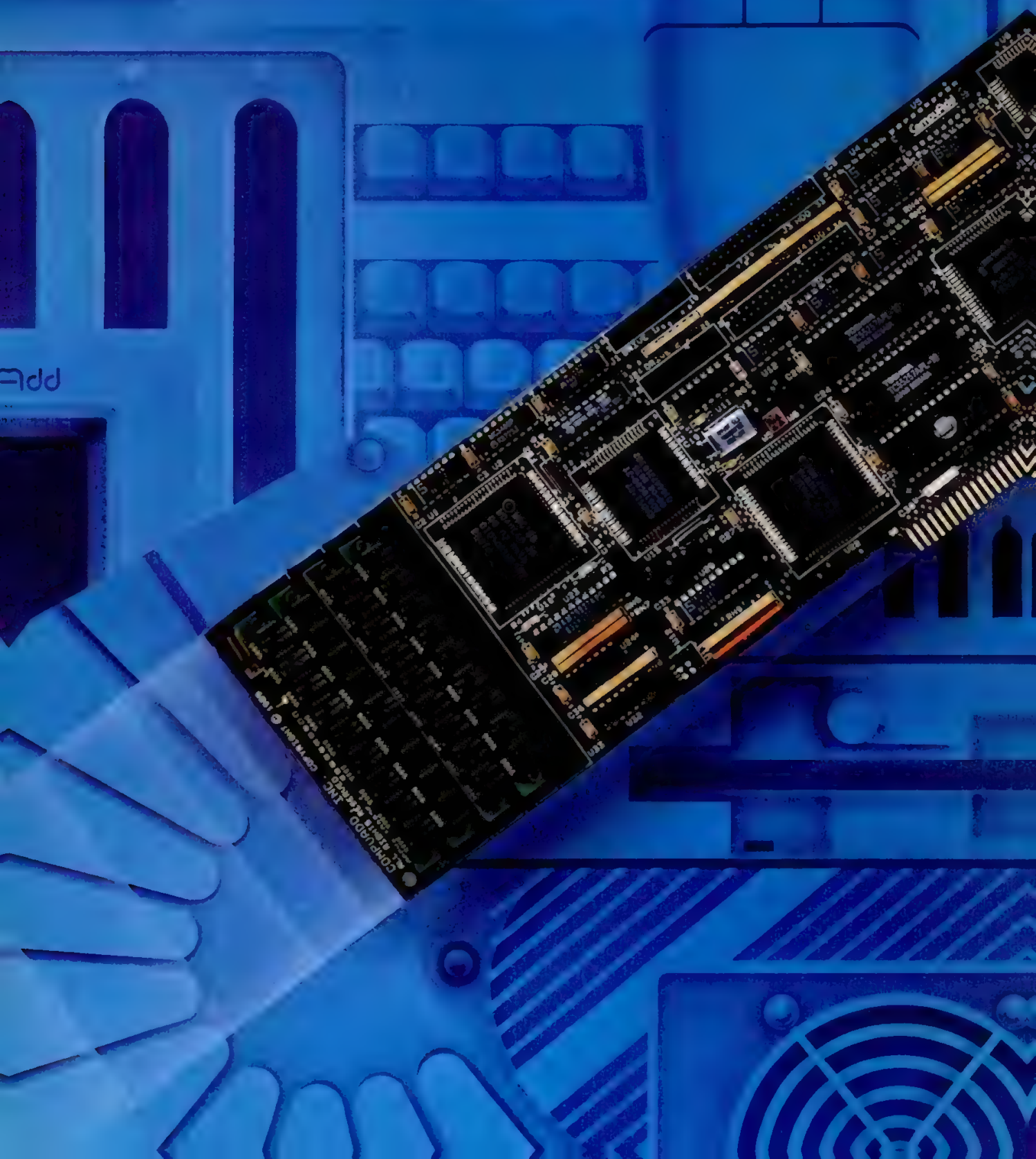
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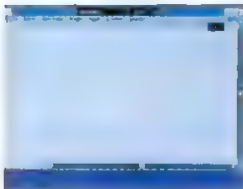
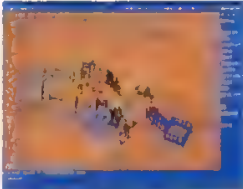
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Spreadsheet Heavyweights Take On 1-2-3

After a two-year wait, 1-2-3, Release 3 is here, but in the meantime it has acquired a host of competitors. Here's how it stacks up against Excel, Quattro Pro, and nine other competitors.

by Craig Stinson

Time was, not long ago, when IBM so dominated the PC marketplace that rumors of an imminent new product could put everybody's plans on hold. Purchasing managers tabled purchasing decisions, and companies designing competing products either rushed to beat IBM out the door or, more likely, waited to see what the giant was going to do before freezing their own designs.

IBM's hegemony may be history, but in the spreadsheet market one company still has that kind of power: Lotus Development Corp. In the 17 months that have passed since *PC Magazine's* last spreadsheet roundup (November 15, 1988), a single event—the arrival of 1-2-3, Release 3—stands out in relief from all others in this area. (The relief was perhaps most keenly felt in Cambridge, Massachusetts.) Though

it was announced in April 1987 with hopes for delivery in early 1988, 1-2-3, Release 3 didn't actually ship until June 1989. When it finally did arrive, however, it revealed the future course of spreadsheet software as envisioned by Lotus. And, with something like 8 million users still at the giant's feet, no one could afford to ignore that.



SEPARATE AND UNEQUAL

The future, says Lotus, lies along two divergent tracks: one for users with advanced hardware, the other for users with first-generation PCs. On those blessed with 286 or 386 PCs and at least 1MB of extended memory, Lotus bestowed a three-dimensional spreadsheet with built-in network support and the ability to access external database files. As a consolation prize to the masses who don't make the hardware cut, the company offered 1-2-3, Release 2.2, a face-lifted version of its best-selling Release 2.01 that runs in 320K of RAM. And forthcoming is an even fancier version, 1-2-3/G for OS/2 Presentation Manager, which will support the graphical user interface while remaining keystroke-compatible with Lotus's character-based products (see the sidebar "Two Spreadsheets for OS/2").

Yet not all vendors have bought into Lotus's vision of the market, and 1989 has seen the emergence of plenty of alternatives from which to choose. Most notable of these is *Quattro Pro* from Borland International, a much-enhanced version of *Quattro* that incorporates some of the advanced technology from *Surpass*, which Borland purchased in September of 1988. *Quattro Pro* offers most of the consolidation capabilities of its rival in a superlative windowing interface and boasts far superior worksheet publishing features, yet runs just fine in 512K of RAM.

1989 also saw Computer Associates and WordPerfect Corp. weighing in with new versions of *SuperCalc* and *PlanPerfect*, respectively, both running under the 640K barrier. And as we were going to press in early 1990, Paperback Software International began to ship *VP Planner 3D*, a three-dimensional upgrade of *VP Planner Plus* that matches 1-2-3, Release 3, in features and power while running in as little as 384K of RAM.

NEW FUNCTIONS, NEW CAPABILITIES

The heated competition among vendors for a share of the huge spreadsheet market has pushed spreadsheet technology to new heights. The dozen programs we review here, including both flavors of *Lotus 1-2-3*, *Lucid 3-D*, *Microsoft Excel*, *PlanPerfect*, *ProQube*, *Quattro Pro*, *SuperCalc 5*, *Twin Level III*, and the spreadsheets in the integrated packages *Enable*, *Framework III*, and *SmartWare II*, have features that place them in a generation beyond the old standard, 1-2-3, Release 2.01. Here are some trends and capabili-

ties to keep in mind as you browse the new spreadsheet marketplace:

■ **File linking.** The days of consolidating spreadsheets laboriously "by hand" using the /File Combine command or its equivalent are over. All of the programs reviewed in this issue have the ability to link cells in different spreadsheet files, allowing changes in supporting worksheets to be reflected more or less automatically in a master consolidation worksheet. Most also allow you to keep more than one file in

memory at once so that you can see the supporting worksheets as you work with the consolidation model. They differ significantly, however, in their implementation of file linking: in the ways that consolidation formulas are updated and in the intelligence with which the programs respond to structural changes in the linked worksheets.

File-linking offers benefits beyond consolidation. The ability to connect worksheets makes it possible to work in smaller modules, reducing the need for huge, memory-eating worksheets. By making it

FINANCIAL PUBLISHING: Making Data Comprehensible—and Fast!

by Robin Raskin

Financial publishing is more than just making numerical data look pretty. In the fast-paced business environment, the numbers for your regularly scheduled summaries and reports may change at the last minute. Yet this financial data must get published quickly and without error.

That's not to say that financial pub-

lication fonts is easier to interpret than reams of row and column printouts.

But in the financial publishing world, spreadsheet data is often only one of the elements in a compound document. Most data-driven reports and proposals combine text, data, and graphics; links from the spreadsheet program to other applications and utilities therefore become paramount.

Division B Statement of Income				
	Mar '88	Mar '89	Mar '90	
Actual		Forecast	Actual	
Sales	174.3	182.3	147.8	
Management fees	40.3	42.8	35.8	

Division A Statement of Income				
	Mar '88	Mar '89	Mar '90	
Actual		Forecast	Actual	
Sales	224.1	195.8	189.8	
Management fees	51.8	54.8	45.8	

Consolidated Statement of Income				
	Mar '88	Mar '89	Mar '90	
Actual		Forecast	Actual	
Sales	400.8	438.3	400.8	

Your figures start out in worksheet form. Three-dimensional spreadsheets such as *Lotus 1-2-3*, Release 3 make updates easier because changes made to the underlying worksheets are reflected in the consolidated worksheet immediately.

lishing doesn't have a make-it-pretty component. This concern is based on the premise that you can lead readers to raw spreadsheet data, but you can't make 'em think about it. Financial publishing helps by presenting it in an attractive, comprehensible, bottom-line fashion. Information summarized in concise tables with embellishments like boxes, borders, grids, and high-resolu-

Hence when you adopt a spreadsheet, you also must adopt the programs with which it interacts.

Lotus Development Corp., WordPerfect, Microsoft, and Borland are the best examples of companies pitching spreadsheet publishing solutions. Borland's *Quattro Pro* exemplifies a stand-alone solution, while the others involve some carefully cultivated bedfellows.

easy to separate raw input values from formulas and reports, it encourages good modeling form, helps ensure data integrity, and reduces duplicated effort. And it lets you create worksheet-independent macro libraries that can be shared and reused with many different worksheets. Most of the programs reviewed here allow macros to reside either in the current worksheet, in the manner of *1-2-3*, Release 2.01, or in a separate macro library.

■ **Three dimensionality.** Besides file linking, *1-2-3*, Release 3 and *ProQuibe* also offer three-dimensional worksheets

that let you create multiple "pages" in a single worksheet file and to define ranges that span two or more pages.

Since some programs that do not offer 3-D let you save groups of separate worksheets in "workspaces," the distinction between file linking and three-dimensionality is easy to overlook. Indeed, the computer press and some of the vendors (like *DacEasy*, for example, whose *Lucid 3-D* is not a three-dimensional program) have pretty well muddled this issue for the

spreadsheet-buying public. The essential feature of a three-dimensional spreadsheet program is the ability to manipulate multi-sheet ranges: solid blocks of cells consisting of several rows and columns on each of several pages. Programs that merely link cells or ranges between two-dimensional worksheets don't qualify.

Other things being equal, file-linking programs that are also three-dimensional offer some advantages over those that link two-dimensional files. They simplify the analysis and graphing of cross-sectional information in a consolidation setup, for

EXCEL-ENT

With good looks and good links, *Microsoft Excel* (available for *Windows*, OS/2, and the Macintosh) is a top-notch candidate for spreadsheet publishing. *Excel* first proved that spreadsheets could be more than just number crunchers, but its publishing power does not come cheap. Its hardware requirements include a 286 (preferably a 386) PC, *Microsoft Windows*, EGA or VGA graphics, and a mouse. The more memory, the better.

There's no disputing that *Excel's* graphical user interface, with its support for fonts and color, borders and boxes gives you the tools to create hard-

hitting charts and tables. Yet feature for feature, *Quattro Pro* now gives *Excel* a run for the money when it comes to financial publishing power. But thanks to the boost it gets from *Windows*, *Excel* is still ahead of the rest of the pack in terms of integration.

Two new *Windows*-based word processors, *Ami Professional* and *Microsoft Word for Windows*, not only contain excellent table making and formatting tools, but also support the Dynamic Data Exchange (DDE) protocol built into *Windows*, which lets *Windows* applications send data to one another.

Early DDE implementations were

crude, but *Word*, *Ami Professional*, and *Excel* are more far more rigorous and reliable about it. Linking data does create a noticeable delay in your document editing, and you often face memory limitations, but that's a small complaint compared to all that DDE offers. For example, you can use *Word's* Paste-Link command to link one range of a formatted *Excel* spreadsheet to a table in a *Word* document, or even just link a spreadsheet cell to a paragraph. If the spreadsheet data changes, the document is automatically updated. If the document changes, the spreadsheet also changes.

CONTINUES

Consolidated Statement of Income			
\$ Millions	Mar '90 Actual	Mar '90 Forecast	Mar '89 Actual
Revenue			
Sales	\$498.0	\$435.0	\$420.0
Management fees	115.0	120.0	100.0
Total Revenue	613.0	555.0	520.0

Costs & Expenses
Operating expenses
General & administrative
Depreciation
Total Costs & Expenses

Gross Income

Interest Expense

Income Before Taxes

Income Taxes

Earnings

Shares Outstanding

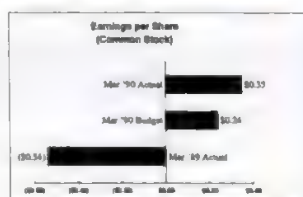
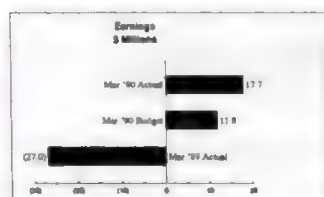
Earnings Per Share

SAMPLE COMPANY MANAGEMENT REPORT: MARCH 1990

Consolidated Operations

Earnings for the month was a profit of \$17.7 million versus a loss of \$27 million posted in March 1989. This is the result of the At Odds case settlement in the company's favor. Earnings per share increased \$0.25 from last month to \$0.35. Revenues for the month were \$613 million, \$93 million over March of 1989 and \$58 million above the March forecast of \$555 million. All three divisions exceeded their forecasted contributions to gross income. March 1989's forecasted gross income was \$20 million. Actual gross income for the month was \$30 million.

Millions	Mar '90 Actual	Mar '90 Budget	Mar '89 Actual
Revenue	\$613.0	\$555.0	\$520.0
Gross Income	30.0	20.0	(40.0)
Net Income	17.7	11.8	(27.0)



Publishing utilities like *Allways* can increase readability by adding attractive fonts, ruled lines, and gray boxes to your printouts. But ultimately you'll want the important figures to be served up in a report format. With the right word processor and graphics package (in this case, *Manuscript* and *GraphWriter*) you can dynamically link the figures into the tables, graphs, and text of the document, letting you update the figures at a single command each month.

In this example, *Lotus Manuscript* is used to incorporate the data from the spreadsheet into a document. Both the table at the upper right and the figures in the paragraph of text are hot-linked to the spreadsheet. Similarly, the graphics were created using *Lotus's GraphWriter*, which also hot-links to the spreadsheet data. A single *Manuscript* command brings in the updated graphs and integrates them into the document.

example. *ProQube* even has commands to "rotate" the three-dimensional structure so that you can view your data along the third dimension as easily as you can along the first two.

■ **Windowing interfaces.** The growing popularity of graphical user interfaces has had a discernible impact on the spreadsheet world. By the time you read this, *Microsoft Excel* may no longer be the only PC spreadsheet running in a graphical environment (see the section "Over the Horizon" below). Meanwhile, *Quattro Pro* and *Lucid 3-D* have shown how effectively

some of the advantages of a windowing environment can be replicated in a character-based program. These programs let you display multiple worksheets in windows that can be sized, moved, zoomed, tiled, and stacked with keyboard commands or mouse. The mouse simplifies range selection and pointing, and the windowing commands make it possible to keep several contexts in view at once.

■ **Worksheet publishing.** Early in 1989, Funk Software's *Allways* arrived, bringing

fonts, styles, point-size options, shading, boxes, and lines of selectable weight to the printing of 1-2-3 worksheets. *Allways* instantly raised everyone's expectations about the quality of spreadsheet output. Never mind that *Excel* had been doing these things for more than a year; it took a 1-2-3 add-in to make the market really take notice. Since then, every major new spreadsheet program has included at least some of these enhanced printing capabilities, and *Quattro Pro*'s built-in Bitstream fonts and superb graphics annotation features are particularly notable.

FINANCIAL PUBLISHING

CONTINUED

QUATTRO PRO: EXCEL-LITE?

Nipping at *Excel*'s heels, *Quattro Pro* emphasizes publishing capabilities but doesn't make the hardware demands of the *Windows* environment. *Quattro Pro* runs in either character-based or graphics mode and can be optimized for a variety of machines in the DOS 640K environment.

Part of its publishing prowess stems from built-in Bitstream fonts: scalable fonts can be rendered on the fly. *Quattro Pro* also builds in line-drawing and box-shading tools. Hot-linked graphs can be embedded in spreadsheets, and text can be linked to the graphed data. A small clip-art library, drawing primitives, and a built-in slide-show feature round out the repertoire, making this the only self-contained solution that lets you create on-screen presentations as well as hard copy.

Quattro Pro can read and write 1-2-3, Release 2 files directly, and you can set it up to be completely keystroke-compatible with the Lotus program. However, *Quattro Pro* has almost no links to external applications, relying on the old .WK1 format to integrate data. It can be slow to print as well.

IN A PERFECT WORLD

PlanPerfect, *WordPerfect*, and *DrawPerfect* present a respectable financial publishing solution, but one with a distinctly nonspreadsheet mindset. The hub of the Perfect trio is clearly word processing.

WordPerfect 5.01's new table editor lets you link in data from *PlanPerfect*, and you can quickly embellish it with

enough fonts, boxes, and rules to knock your socks off. Bring *DrawPerfect* into the act and you can add arrows, logos, and scanned or clip art. *DrawPerfect* also offers a slide show capability and imports a sizable number of graphics file formats.

One advantage to using this trio is that the interface is consistent among them. But realize that *PlanPerfect* is doomed to remain *WordPerfect*'s low-profile sidekick. It's doubtful that it will ever be a robust rival for competing standalone spreadsheets.

PlanPerfect's links to the non-Perfect world are shaky, too. The program tries to incorporate an optional Lotus interface but doesn't pull it off very well; it also bungles the translation from the .WK1 format. *WordPerfect* itself imports .WKS, .WK1, and *Excel* spreadsheets but loses many of the original formatting attributes in the process. For this reason, the Perfect group isn't the best choice unless you're already a *WordPerfect* office.

THE GREAT DIVIDE

Lotus's release of 1-2-3, 2.2 and 3.0 fractured the once-monolithic Lotus community. The split is based on equipment: Release 2.2 for configurations that include 8088s, and 3.0 for 286s and more powerful machines.

Contrary to what you may think, when it comes to spreadsheet publishing, Lotus's newest release is not best. While the long-awaited 3.0 certainly made good on its promise of new and more-powerful analytical capabilities, spreadsheet publishers are left in the cold.

Spreadsheet publishing in Release 3.0 is a bet on a promise. No doubt Lotus will make good on its pledge to add *Allways* or similar capabilities to Release 3.0, but it's still uncertain whether the implementation will be a third-party add-in with a new interface (like the proposed LEAF), or built into Release 3.01. Regardless, the slow pace at which 3.0 unfolded in the first place has not instilled much confidence.

File compatibility is another drawback. With the exception of Lotus's own *Manuscript* and *Freelance Plus*, no programs accept Release 3.0's .WK3 files. Today's 3.0 users must translate their .WK3 data to the more standard .WK1 and .WKS files for data exchange, just like everyone else.

In its wisdom, Lotus bundled Funk Software's *Allways* with Release 2.2 for free. First available as an add-in for Release 2.01, *Allways* staved off many an *Excel*-thirsty user by accommodating WYSIWYG previews, support for downloadable fonts and font cartridges, and better formatting such as boxes, lines, and shading. PC Publishing's *Impress*, though not bundled with 1-2-3, has the advantage of letting you edit directly on the WYSIWYG display instead of jumping back to the spreadsheet as you must do with *Allways*.

There's a great deal to look forward to in 1-2-3/G, Lotus's graphical spreadsheet for Presentation Manager. It adds much-needed twists, such as the use of color palettes by selection and a handsome preview window, to the spreadsheet-by-GUI theme. At same time, it uses keyboard-compatible cascading menus, a boon to those migrating from the character-based world. Lotus and *WordPerfect*'s recent technology-shar-

■ **Interoperability.** Until recently, if you wanted a spreadsheet program with file-compatible versions running on different computing platforms, your choice was *Excel*. Now, in addition to *Excel* (which runs on the Macintosh, under *Windows*, and under OS/2 Presentation Manager), there's *1-2-3*, Release 3 (with versions for character-mode OS/2 as well as DOS), and the forthcoming *Wingz* (a Macintosh product that will appear eventually in *Windows* and Presentation Manager versions). And *1-2-3/G*, running under Presentation Manager, promises full file compatibility with

ing agreement should allow cozy data exchange between *1-2-3/G* and the upcoming PM version of *WordPerfect*—good news for spreadsheet publishers.

THE ROADS NOT TAKEN

Any package that generates a .WK1 or .WKS file can be tweaked to become part of a financial publishing solution, and that means just about all of them. *SuperCalc5* is a more serious contender than most. It's got analytical power, excellent graphics, and even word wrap for lengthy annotations, though it lacks dynamic links to other applications or WYSIWYG add-ins.

Desktop publishing programs may appear to be obvious candidates, but appearances are deceiving. First off, the people who prepare spreadsheets for publication are often administrative or secretarial staff who are more comfortable with word processors and spreadsheets than with DTP programs. And second, facilities to set up permanent links between spreadsheet and DTP programs are almost nonexistent. *Ventura Professional Extension's* data integration falls short when compared with *Word* or *WordPerfect's* ability to work directly with spreadsheet data.

Xerox has ambitious plans to make *Ventura Publisher* a hub of spreadsheet and database publishing, and other programs such as *dbPublisher* are already adding oomph to this scenario. The picture may change more when Aldus upgrades *PageMaker* to support DDE, or when the OS/2 environment provides better tools for linking data. But for now, DTP programs are best reserved for less hurried, more design-intensive jobs than financial publishing. ■

both variants of *1-2-3*, Release 3.

It's equally important to consider the company that a spreadsheet keeps. One of *Excel's* big advantages is its support of Dynamic Data Exchange (DDE), a *Windows* protocol that allows a growing number of applications to exchange information in memory without user intervention. With DDE, you can insert a spreadsheet or graph from *Excel* into a *Word for Windows* or *Ami Professional* document, and any changes you might make in the spreadsheet would be reflected immediately in the document, and vice versa. If your work requires such two-way "hot" or dynamic links, *Windows* is your environment of choice.

Eventually, you may be able to create similar links between Lotus applications with the help of the Lotus Programming Language (formerly known as LEAF), but so far this is available only for *1-2-3*, Release 3. Lotus and WordPerfect Corp. have also promised that *1-2-3/G* and the forthcoming Presentation Manager version of *WordPerfect* will have easy two-way dynamic linking between them, but as yet no arrival date has been named for the latter.

In the meantime, *1-2-3's* .WK1 format is the lingua franca of the spreadsheet world and is understood by a growing number of nonspreadsheet applications as well. If your spreadsheet exports to .WK1 files (and most of them do), you can "warm link" your worksheets to documents created by one of the two dominant word-processing programs, *WordPerfect 5.1* and *Microsoft Word 5.0*. These let you embed worksheets into your documents and refresh the information from disk each time you call up the document file, which is sufficient for many applications.

■ **Database connectivity.** One of the most important advances that *1-2-3*, Release 3 offers over previous versions of *1-2-3* is DataLens, a protocol that allows Lotus and third parties to write drivers for accessing external databases. With the right driver in place, you can perform queries and extracts on remote data files with essentially the same commands you'd use to analyze data in a worksheet file. Lotus supplied a sample driver for *dBASE III/dBASE III Plus* files with the first shipment of *1-2-3*, Release 3. At press time, no other DataLens drivers had emerged, but third-party drivers for *Oracle*, Novell's *NetWare SQL*, Microsoft's *SQL Server*,

OS/2 Extended Edition's data manager, and others are expected later this year.

Microsoft has countered by practically giving away copies of Pioneer Software's *Q+E* utility with *Excel*. *Q+E* gives *Excel* users essentially the same *dBASE* outreach capability that the sample DataLens driver gives to *1-2-3*, Release 3 users. Borland followed suit in *Quattro Pro*, giving it easy connectivity to the company's own *Paradox* and *Reflex* database files, as well as to *dBASE* files.

REVIEW CRITERIA

For this review, we selected file-linking spreadsheet programs—with or without three-dimensional capability—that were

It's equally important
to consider the
company that a
spreadsheet keeps.

available by early December 1989. The 12 that met these criteria include a little of everything: a memory-resident spreadsheet with strong links to a particular set of accounting software (*Lucid 3-D*), three high-end integrated packages (*Framework III*, *Enable*, and *Smartware II*) with strong spreadsheet components, a rather small-scale three-dimensional program with rotational capability (*ProQube*), and five of the strongest Lotus challengers (*Microsoft Excel*, *Twin Level III*, *SuperCalc5*, *PlanPerfect 5.0*, and *Quattro Pro*). Also meeting the test, of course, were the two latest from Lotus: *1-2-3*, Releases 2.2 and 3.

One program that did not meet our criteria but is worth a look anyway is *TM/1* from Sinper Corp. (Warren, New Jersey). Described by its vendor as a "relational spreadsheet," it uses a relational database instead of worksheet file-linking to structure your data. While it's an impressively powerful tool for analyzing three-, four-, or even five-dimensional models with lots of data, it has little in common with the programs reviewed here.

OVER THE HORIZON

We set our editorial schedules far in advance of publication; even so, this time around we were unlucky enough to miss

the release dates of four major new spreadsheets: *1-2-3/G*, *Twindows*, *VP Planner 3D*, and *Wingz*. By the time you read this, some of these programs may be available.

Informix's *Wingz*, a transplant from the Macintosh, will bring an interface even more visually exciting than *Excel*'s to both OS/2 Presentation Manager and *Microsoft Windows*. *1-2-3/G* for Presentation Manager and *Twindows* for *Windows* (graphical versions of *1-2-3*, Release 3 and *Twin Level III*, respectively) promise all the functionality of their DOS counterparts—and more. *VP Planner 3D*, keeping the faith in the character-based world, will

be a much-enhanced upgrade of *VP Planner Plus*, with three-dimensional worksheets and rotational commands à la *ProCube*.

Farther around the bend, it would not be unreasonable to expect a new version of *Microsoft Excel*, which hasn't seen a major upgrade since 1987. Even without an overhaul, *Excel* stands to gain more speed and capacity plus improved network support sometime in 1990, if rumors about the upcoming new version of *Windows* are to be believed. As we went to press, Lotus

was openly discussing the possibility of a *1-2-3/G* for *Windows* as well, but had made no commitment to deliver it. And Borland announced its intention of developing both *Windows* and Presentation Manager versions of *Quattro Pro*.

HOW WE TESTED THEM

We subjected the 12 spreadsheets reviewed here to a common testing script that evaluates both quantitative and qualitative attributes. We measured worksheet capacity and memory usage; logged recalculation times for several different kinds of worksheets; created file links, then moved and renamed the linked cells to see if the programs kept in step; created, customized, and printed charts; and measured sorting times for a large internal database. The results are recorded in a performance chart and a features table.

In addition, the reviewers were asked to assign suitability-to-task ratings for five categories of work: conventional spreadsheet operations, consolidation (with file linking and/or 3-D worksheets), analytic graphing, presentation services (quality output from both worksheets and graphs), and interoperability (manual and automatic links with other applications and platforms). For each category, a program received a rating between 0 (completely unsuited) and 4 (best for the task).

AN UPHILL ROAD

While *1-2-3*, Release 3 made a brief appearance on *PC Magazine*'s Pipeline (a measure of the top ten sellers at retail) when it was first released, for most of late 1989 and early 1990 the only spreadsheet program on the Pipeline Top Ten was—*1-2-3*, Release 2. This reveals an important truth: spreadsheet users care more about getting their work done than about the latest, hottest worksheet technology.

As Lotus itself is discovering, chipping market share away from the Release 2 standard is like trying to erode Gibraltar with a seltzer bottle. For every pair of users ready to jump, there must be three newcomers eager to embrace the current standard, and all for the best of reasons: millions of dollars invested in training and applications are of more account than a new set of file-linking features.

Nevertheless, the market gets larger, and as it does, so does the number of users for whom the old *1-2-3* standard is no longer enough. A growing number of vendors stand ready to serve you, and you'll find their offerings on the following pages.



FILE-LINKING SPREADSHEETS: SUITABILITY TO TASK

With the definition of spreadsheet work expanding far beyond simple number-crunching, more than ever you must choose your spreadsheet according to the jobs you'll require it to do. The informed subjective ratings below can help you toward this goal. Compare them with the product reviews, the features table, and the performance tests for a complete picture of what each product offers.

THE TASKS

Each spreadsheet program is rated according to its usefulness in five areas. The first rating, **Conventional Spreadsheet Work**, evaluates the product for the bread-and-butter tasks a spreadsheet is called upon to do. It is based on the number and richness of commands and functions, on the extent of the program's macro language, and on special features such as auditing—as well as on performance and memory usage.

The second measure, **Consolidation**, reflects the ease with which the product handles this very common spreadsheet task. True three-dimensional packages have the upper hand in this category, but the score for a file-linking spreadsheet indicates how easy it is to make the links and whether you can group files together in memory or on-disk.

The third, **Analytic Graphing**, is a measure of the product's ability to help you turn your numbers into pictures. The score depends on the number and strength of the program's graphing features, as well as its facilities for customizing, annotating, and viewing your graphs. This category is focused on analysis, not presentation.

The quality of the printed graph is evaluated as part of the fourth category, **Worksheet Publishing**, which also takes into account the program's font support, its ability to dress up worksheets with



boxes, lines, and shading, and the clip art it can import. The ability to integrate graphs and worksheets on the same page is also an important factor in the publishing measure.

The final category, **Interoperability**, is a broad measure of how well the program works with other applications and other platforms. Support for hot or warm links with other applications such as communications programs and word processors is important, as is the ability to query and write to external database files directly. Naturally, spreadsheets that are part of integrated programs do well on this measure. Also figuring into the mix is the ease with which you can exchange data, formulas, and macros in an environment that may include Macintoshes as well as DOS and OS/2 PCs. The best in this regard are those spreadsheets whose files are compatible with versions running on other platforms.

THE RATINGS



THE FINE ART OF DISC DRIVES



Beveled Glass Window by
Thomas Tisch & Andreas Lehmann
Oakland, California

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Until now.



microLaserTM from Texas Instruments: the affordable PostScript printer you can call your own.

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At only 13.4 inches wide and 14.2 inches deep, microLaser may be the small kid on the block, but it packs plenty of punch. This printer takes full advantage of the advanced software that runs on your PC. That's because it uses the Adobe® PostScript printer language and is compatible with the HP LaserJet®

Because microLaser features the PostScript language, you can print fonts in a variety of type styles and sizes. Plus, you can print them tall-ways, long-ways, all kinds of ways. You can even print complex pages of integrated text and graphics.

Capabilities that grow as your needs grow.

One of the best things about microLaser is that you only buy what you need. So if you're not ready for PostScript language, you can buy the standard microLaser for less than \$2,000 and add PostScript software and other powerful features later.

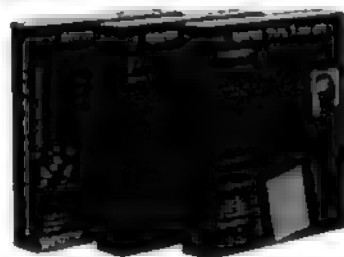
You can upgrade microLaser without tools or technicians by simply adding upgrade boards. These boards include up to four 1 Mb increments of memory, serial and AppleTalk® interfaces and a PostScript interpreter. All you have to do to get additional fonts or emulations is plug optional microCartridges into two credit card-size slots.

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INSTRUMENTS**

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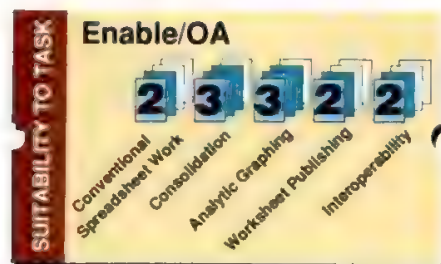
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Enable/OA

by Henry Fersko-Weiss

Enable Software's \$695 *Enable/OA* integrated software offers a spreadsheet module chock-full of functions, including both linked and 3-D files and dazzling graphics facilities. The spreadsheet's command system uses the two-line horizontal menus made familiar by *Lotus 1-2-3*; the structure is consistent throughout the word processing, database, and communications modules. Happily, transferring data between the applications is as easy as jumping into the next window.

But the integrated nature of *Enable* leads to some weaknesses. Because there are so many application choices, some commands take quite a few keystrokes to



issue. For instance, most spreadsheets present you with a blank worksheet as soon as they're loaded, but in *Enable* you must first go through a configuration screen, make three menu selections, and then name a file before you get to the same place. Opening a second spreadsheet window requires pressing six different keys and typing in a filename. Even the speed-key sequences can require as many as three keystrokes. Hence the advantage of working with several applications at once must be weighed against the trouble of this extra finger work.

ENABLING YOUR SYSTEM

Enable's worksheet screen is utilitarian, offering the bare minimum of styling and allowing for little color variation. The only information you see, aside from the row and column labels and the current cell contents, is the mode, filename, highest cell address, and window number. The program doesn't support a mouse.

Enable's windows are one of the best parts of its interface: eight can be open at once, and they can be resized, moved, and split horizontally or vertically. You can put a copy of the same spreadsheet in two or more windows to compare alternate as-

sumptions at a glance. Windows also make it easy to copy data between spreadsheets or from a spreadsheet to another application; inserting a spreadsheet and graph into a word processing document or pulling database information into a worksheet is made quite simple. You can even work on a file in one window while a time-consuming process, such as a database sort, goes on in the background of another window.

Enable's three-dimensional spreadsheets offer dynamic links between worksheets, which are automatically updated in memory when you recalculate. *Enable* also permits a form of file linking that lets you tie worksheets together without opening more than one. One of the program's handy tricks is the ability to display the three levels of a 3-D spreadsheet in one window; you can also hide up to 29 levels so they won't print.

BIG AND BEAUTIFUL

A worksheet in *Enable* can be as large as 1,024 columns by 9,999 rows. You can carry this worksheet down to 32 levels, giving you almost 328 million cells with which to work. However, these figures can be deceiving. Because of the way memory is managed in *Enable*, any cell with more than 256 characters of information and references must be stored in conventional rather than expanded memory; thus you can quickly hit the 640K wall. This problem occurred the first time we tried to import such a highly referenced worksheet for our first benchmark test. Though this situation is hardly representa-

Enable/OA's windows can contain different worksheets or different portions of the same worksheet. You can split each window horizontally and vertically.

Horizontal Vertical Sync Unsync Clear						CORN	
Horizontal window independently of each other							
1	A	B	C	D	E	F	
2	MONTHLY SALARY TEND FOR XYZ CORPORATION						
3		1987	1988	1989			
4 JAN		1,228.00	328,588.00	668,789.00			
5 FEB		13,221.00	332,227.00	691,305.00			
6 MAR		13,878.00	372,158.00	744,893.00			
7 APR		24,514.00	388,954.00	754,827.00			
8	A	B	C	D	E		
9	Monthly						6
10	Cumul						7
11	Month/Loan Balance	Payment to	Payment to			8	Payment to
12	Number/for Payment	Interest	Principal			9	Interest
13	1	99,958.81	791.67	49.19	11	791.67	
14	2	99,981.24	791.28	49.58	12	1,582.94	
15	3	99,951.27	796.88	49.97	13	2,373.83	

FACT FILE

Enable/OA

Enable Software,
Northway Ten Executive
Park, Ballston Lake, NY
12019; (800) 888-0684,
(518) 877-8600.
List Price: \$695.

Requires: 640K RAM,
hard disk recommended,
DOS 2.0 or later.

In Short: This integrated program's spreadsheet offers welcome three-dimensional facilities and (with *Perspective*) excellent graphics. But it suffers from memory management problems and slow performance.

CIRCLE 416 ON READER SERVICE CARD

tive of most spreadsheet work, that doesn't excuse *Enable's* problematic memory management.

Nearly 140 functions are available, including some not found in *Lotus 1-2-3*, such as cumulative percentages. You can format numbers in 19 different ways, and the labels can be bold, underlined, or italic; if you want to get any fancier, you'll have to transfer the worksheet into *Enable's* word processor.

Enable's native graphics facilities can produce only the standard two- and three-dimensional business graphs and support a maximum of only eight data points. But *Perspective*, an add-on that comes with it from Three-D Graphics of Pacific Palisades, California, lets you graph your *Enable* data in a spectacular variety of ways. For instance, it lets you turn the bars in a 3-D bar graph into drum-like shapes, then lets you stretch a bar to make its closest point seem even closer. Thirty-two preset

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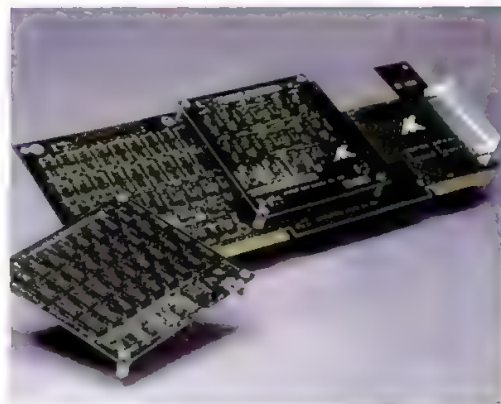


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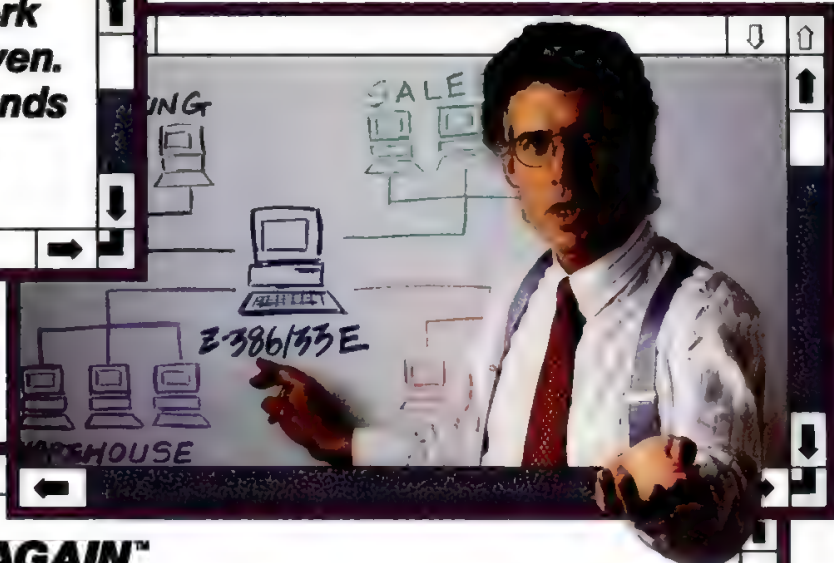


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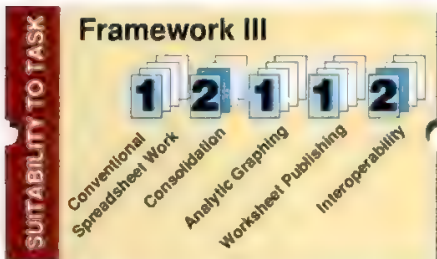
graph types can display your data in ways ranging from beautiful to bizarre, and the color choices are splendid.

As a spreadsheet, *Enable* is merely standard, though its integration with the other applications in the *Enable* series is good and its ability to access *Perspective*'s fancy graphics is quite a plus. If either of these considerations has a high priority with you, *Enable* may be worth a look. But its clumsiness and its memory limitations make others a better choice if spreadsheets are your main application.

Framework III

by Henry Fersko-Weiss

Ashton-Tate's \$695 *Framework III* combines spreadsheet facilities with word processing, database, and communications within an innovative windowing interface that has its own programming language. You'll appreciate *Framework*'s visual appeal: it uses on-screen color and pull-down menus effectively and lets you move, resize, and zoom worksheet windows with ease. But its spreadsheet is basic in most respects and positively anemic in others.



Only its size (32,000 rows by 32,000 columns) makes it stand out in the spreadsheet arena.

As you may know, *Framework* has its own terminology. The main work area—the desktop, in *Framework* parlance—can hold an unlimited number of “frames,” or windows. You can move and size the frames in conventional fashion, then collapse them down to their titles in the “frame tray” at the lower-right-hand corner of the desktop. This makes it easier to keep many frames open at once, ready for expansion when you need them.

But the heart of the design lies in “containing frames” that can be used to hold and save a number of related frames together as a unit. A containing frame holds other frames inside it. These may be simply a collection of frames, similar to papers thrown together in a folder, or they

can be part of a highly structured outline with levels and sublevels. With containing frames, you can tie different types of documents together and alter their contents simultaneously simply by highlighting the border of the containing frame, or one of the lower-level containing frames, then issuing format commands.

This design is a powerful integration tool. For example, you might set up a containing frame for new products, with a top outline level holding a word processing document on company goals, a graph showing purchase patterns, and several variants of a balance sheet for the next five years. Then, at the second level under each of these frames, you would have other word processing, graph, and spreadsheet frames displaying the supporting details.

RATING THE SPREADSHEET FUNCTIONS

The spreadsheet facilities in *Framework* are straightforward. The numeric formats are just as basic: date, integer, currency, and the like.

Although there are a great many *Framework*-specific functions for use in formulas, the program is a little weak on the standard spreadsheet functions. You get only six financial and seven statistical functions, though logic and math functions are more numerous. It offers bold, italic, underline, strike-through, superscript, and subscript. You can see these on the screen, which is nice, but it would be better to have a wider selection of text enhancements.

The graphing facilities in *Framework* are also weak. The program offers only six basic graph types: bar, line, pie, point, xy,



FACT FILE

Framework III

Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90509; (800) 437-4329, (213) 329-8000.

List Price: \$695;

upgrade from any previous version, \$99;

Framework III LAN, \$995 for five users.

Requires: 640K RAM, hard disk recommended, DOS 2.0 or later.

In Short: *Framework III* sports an attractive and innovative user interface whose outlining metaphor makes it possible to integrate spreadsheets, documents, and database information in a very sophisticated fashion. Sadly, its spreadsheet is undistinguished, with weak functionality and poor graphics. Power spreadsheet users should go elsewhere if they need an integrated package.

CIRCLE 418 ON READER SERVICE CARD



and hi-lo-close-open. You can vary these slightly, but you can't produce a 3-D graph or change to a horizontal orientation. Labels must appear across the first row or down the first column to be picked up in the legend or used along the x-axis, and you have no control over the position of the legend. You also can't control the colors or hatching pattern for graph elements, or the text size and fonts used in labels and the legend. In our test bar graph, the title “Monthly Salary Trend for XYZ Corporation” ran right over the legend because of its length, and the only way to fix it was to shorten the title or use *Framework*'s internal programming language to create a two-line title.

As you might expect, *Framework III*'s strong point is that it lets you link spread-



Framework III's “containing frames” are the heart of the program's integration capabilities. Files in a containing frame are saved, loaded, and updated as a unit, so you can create compound documents linked in an outline-like format.

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*Josh Mailman, President
Market Valuation Research*



First Interstate Fire, 5/4/88, Los Angeles

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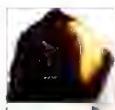
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sheets together easily. Consolidated links let you tie a cell in one worksheet to a computed value in another. You might, for example, sum a group of cells and then bring that total over to your linked cell. Its weak point is performance. You can't recalculate in the background, and foreground recalculation is slow—near the bottom of the pack, according to our performance tests.

Framework's unique outlining abilities merit consideration from anyone looking for an integrated package. But the weakness of its spreadsheet module and the limitations of its graphics facilities make it a questionable choice if the spreadsheet is your most important application.

Lotus 1-2-3, Release 2.2

by M. David Stone

Lotus 1-2-3 has been the spreadsheet standard on DOS machines almost since it first came out, but with the introduction of Releases 2.2 and 3.0 and the pending release of *1-2-3/G*, this once-solitary standard has branched out. Of the three, Release 2.2 is the most conservative choice: it can run even on an ancient, dual-floppy disk PC with as little as 320K of RAM.

Priced at \$495 (or \$150 for an upgrade), Release 2.2 improves on the old

as a spreadsheet. But you can also use it to dress up your worksheets with Helvetica and Times-Roman look-alike fonts ranging in size from 5 to 24 points, as well as adding boxes, lines, and shading. *Allways* creates visually striking output, with or without graphic elements, but its usefulness suffers from its incomplete integration into *1-2-3*. For example, if you want to use the *1-2-3* Print menus for draft output and *Allways* for quality hard copy, you'll find that you have to set the print range separately in *Allways* and in *1-2-3*. *Allways* also requires a minimum of 512K of RAM in your PC, so you'll need to consider that if you often create spreadsheets that strain the memory in your system.

File linking is another notable feature that is new to Release 2.2. Now you can read data from one or more .WK1 or .WKS files into your worksheet. This feature is long overdue and is still somewhat primitive when compared with the linking facilities in *Excel* or Lotus's own Release 3, but it's welcome nevertheless.

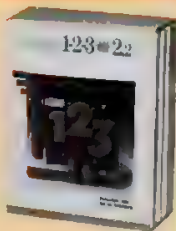
A FAMILIAR FACE

Release 2.2's biggest advantage is its antecedents; anyone familiar with Release 2.01 will be immediately comfortable with 2.2. Its menus are essentially the same, though they do contain additional choices hidden in various nooks and crannies. Even the *Allways* menus follow the familiar Lotus logic. A nice extra touch is the addition of setting sheets, which show you all the current settings for a given function. For example, if you choose /Worksheet Global, Release 2.2 displays all the global settings, so you don't have to reset them all

PC FACT FILE

Lotus 1-2-3, Release 2.2
 Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: \$495 (includes *Allways*).
Network server version: \$595 plus \$295 per node. Upgrade from any previous release, \$150 (\$90 without *Allways*).
Requires: 320K RAM, two disk drives, DOS 2.0 or later. *Allways* requires 512K RAM and a hard disk.
In Short: *1-2-3*, Release 2.2, is no longer the undisputed standard. But it runs well on virtually any DOS system, and the eye-catching output that *Allways* produces brings it up to that of the competition in desktop publishing and graphics. It's still an excellent choice for long-time *1-2-3* users who don't need the sophisticated linking features that Release 3.0 or competitors offer.

CIRCLE 419 ON READER SERVICE CARD



to be sure they're right.

An undo command, a learn mode for macros, and a macro manager (an add-that lets you keep macros in memory separate from the spreadsheet) are all new Release 2.2. You can now find label as formula text (using the program's /Ran; Search command), and you can finally invoke Release 2.2 with a particular worksheet from the command line. Also included are network controls that prevent users from changing the same file at the same time (a network server version is also available).

1-2-3, Release 2.2 breathes new life into a hardy classic. It's not as sophisticated as much of its competition, but if you're barely bumping up against Release 2.01 limitations, Release 2.2 offers the bene

SUITABILITY TO TASK

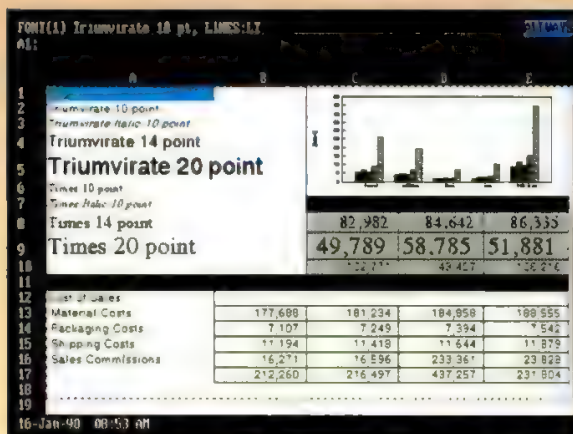
Lotus 1-2-3, Release 2.2



Conventional Spreadsheet Work
Consolidation
Analytic Graphing
Worksheet Publishing
Interoperability

2.01 standard with a number of new features. Certainly the most eye-catching of these is its better-looking output. Part of the credit is due to Release 2.2's better graphics capabilities (for example, instead of keeping all the x-axis labels on one line, it automatically creates two lines if necessary). But most of it is due to *Allways*, a printing and formatting add-in that Lotus bundles with Release 2.2.

Allways makes printing more convenient. It prints graphs without forcing you to leave *1-2-3* and go to PrintGraph. It lets you print spreadsheets in either portrait or landscape orientation. And it lets you include one or more graphs on the same page



Allways, a printing and formatting add-in included with *1-2-3*, Release 2.2, creates eye-catching output with fonts, boxes, lines, and shading in a WYSIWYG environment. It lets you print a graph and the corresponding worksheet on the same page.

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PRO—a \$495 value—for only \$99⁹⁵, with absolutely NO RISK. If, within 60 days, you're not completely satisfied—return QUATTRO PRO for a no-questions-asked refund.

Lotus' "choice" of upgrade products is really a compromise! 1-2-3 release 2.2 has advanced publishing. Release 3.0 offers multi-page consolidation. Neither has both. QUATTRO PRO lets you do *both* multi-page and free-form consolidation—*AND* advanced publishing.



without translation. And VROOMM enables QUATTRO PRO to run on PCs ranging from an XT-class machine to an 80486.

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The computer industry's top software evaluators have unanimously picked QUATTRO PRO. So Lotus 1-2-3 owners, isn't it worth \$99⁹⁵ to find out why?

REPORT CARD		INFO WORLD					
High-End PC Spreadsheets		QUATTRO PRO Version 1.0	Lotus 1-2-3 Release 2.2	Lotus 1-2-3 Release 3.0	Plan Perfect Version 5.0	Excel/Windows Version 2.1	Supercalc II Version 3.0
Feature	Price	\$99 ⁹⁵	\$495	\$495	\$495	\$495	\$495
Formulas/analysis (100)	Good	Good	Good	Good	Excellent	Good	Good
Compatibility (90)	Excellent	Excellent	Excellent	Good	Very Good	Very Good	Very Good
Speed (75)	Very Good	Very Good	Very Good	Very Good	Satisfactory	Very Good	Satisfactory
Database (75)	Excellent	Satisfactory	Very Good	Very Good	Very Good	Very Good	Very Good
Graphics (75)	Excellent	Poor	Good	Good	Good	Very Good	Very Good
Output (80)	Very Good	Very Good	Satisfactory	Good	Excellent	Good	Good
Macros (80)	Excellent	Good	Good	Good	Excellent	Good	Good
Consolidation and linking (80)	Excellent	Satisfactory	Excellent	Satisfactory	Very Good	Very Good	Very Good
Capacity (80)	Very Good	Very Good	Very Good	Very Good	Good	Good	Good
Screenworkflows (75)	Excellent	Excellent	Excellent	Satisfactory	Excellent	Very Good	Very Good
Ease of learning (70)	Excellent	Very Good	Very Good	Satisfactory	Very Good	Very Good	Very Good
Ease of use (100)	Very Good	Very Good	Excellent	Good	Excellent	Good	Good
Screen installation (80)	Very Good	Poor	Very Good	Poor	Very Good	Very Good	Very Good
Support							
Support policies (80)	Very Good	Very Good	Very Good	Excellent	Very Good	Satisfactory	Satisfactory
Technical support (80)	Good	Satisfactory	Satisfactory	Very Good	Very Good	Satisfactory	Satisfactory
Value (100)	Excellent	Very Good	Excellent	Good	Excellent	Very Good	Very Good
Final Scores	8.6	6.6	7.9	6.0	8.5	6.7	

When InfoWorld tested and compared six different, high-end PC spreadsheets, QUATTRO PRO outscored them all.

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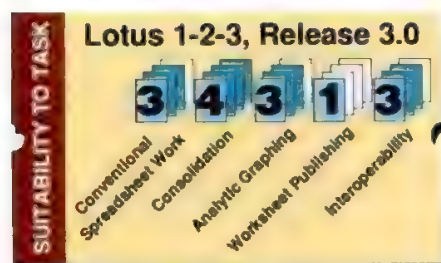
CIRCLE 377 ON READER SERVICE CARD

of familiarity while remaining compatible with all your previous add-ins and giving you far better-looking output.

Lotus 1-2-3, Release 3.0

by M. David Stone

1-2-3's Releases 2.2 and 3.0 descend from the same ancestor, so it's not surprising that they have so much in common. They even sport similar prices, with the \$595 Release 3.0 listing for a scant \$100 more than Release 2.2. But the two programs are quite dissimilar in important respects, of which 3.0's increased hardware requirements and its support for OS/2 are only the most obvious. It's misleading to view Release 3.0 as merely a bigger and better version of the old standard; in fact, it's a brand-new program that happens to be modeled on Lotus's best-selling classic.



Since it uses DOS extender technology to reserve more memory for spreadsheets, the DOS version of 3.0 requires a 286- or 386-based PC with at least 1MB of extended (not expanded) memory. The OS/2 version requires at least 3MB of RAM; 4MB is recommended. Lotus supplies both a DOS and OS/2 version in its Release 3.0 package; you can install either one or both. In operation, the two versions are essentially identical.

Release 3.0's most significant new features are first, its three-dimensional workspace, which lets you build multipage worksheets and work with multiple files in memory, and second, its file-linking abilities, which allow you to write formulas in one file that address 2- or 3-D ranges in another. The two features work similarly in some ways. In either case, you can, for example, see up to three spreadsheet pages on the screen at once and move easily from one to another. But in fact, using a three-dimensional worksheet gives you some additional capabilities; with it, you can

TWO SPREADSHEETS FOR OS/2

by Craig Stinson

The number of spreadsheets available for OS/2 Presentation Manager is about to triple. Microsoft has had this corner of the software marketplace to itself since bringing out *Microsoft Excel* for OS/2 last autumn. But before summer arrives, *Excel* will be matched by two impressive newcomers: *1-2-3/G*, from Lotus Development Corp., and *Wingz*, from Informix Software.

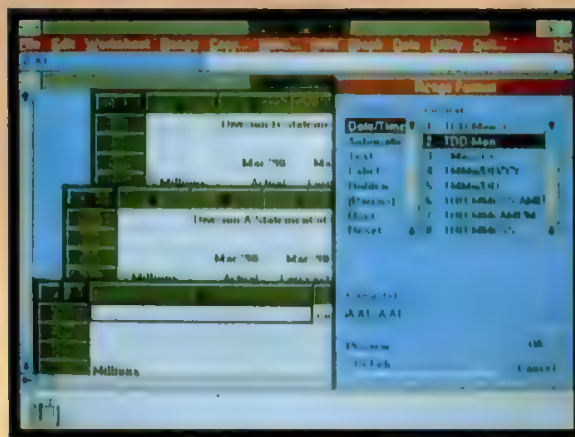
The two challengers are a study in contrasts. With *1-2-3/G*, Lotus has taken great pains to make the graphical environment palatable to its huge installed base of inveterate keyboarders, many of whom still think that the acronym GUI is more an adjective than a noun. *Wingz*, born on the Macintosh, is unabashedly graphic—replete with buttons, drawing tools, slide bars, handles, and pickers.

1-2-3/G is selective and conservative in its exploitation of PM's graphic potential, as if to underscore the premise that worksheets are for work. Its

last there are area graphs, as well as overlapping bars and 3-D perspective bars to set data series off from one another. Overall, however, *1-2-3/G* does nothing to move Lotus from its traditional position at the back of the pack when it comes to graphing capabilities.

By contrast, *Wingz* is probably the most visually plastic spreadsheet environment ever created. A *Wingz* worksheet can not only sprout any number of graphs but can also be adorned with pictures, geometric and freehand shapes, text fields (complete with word wrapping, tab, margin, and line-spacing options), and action buttons linked to macro scripts. You can put these "objects" anywhere you want, including on top of one another.

Wingz offers more types of graphs than you will know what to do with. Besides the customary business formats (bar, line, pie, xy, hi-lo) in the usual variations (stacked, 3-D, horizontal, combination), you get such exotic species as polar, contour, surface, and



Lotus's 1-2-3/G makes great efforts to blend the working methods of its character-based interface into the graphical Presentation Manager environment—with excellent results.

worksheet windows can be sized, moved, tiled, overlapped, and zoomed. Text and numbers can be formatted in a variety of fonts and styles, and ranges can be boxed and shaded. But *1-2-3/G* worksheets remain strictly for numbers and text: graphs reside in separate windows, as they do in *Excel*.

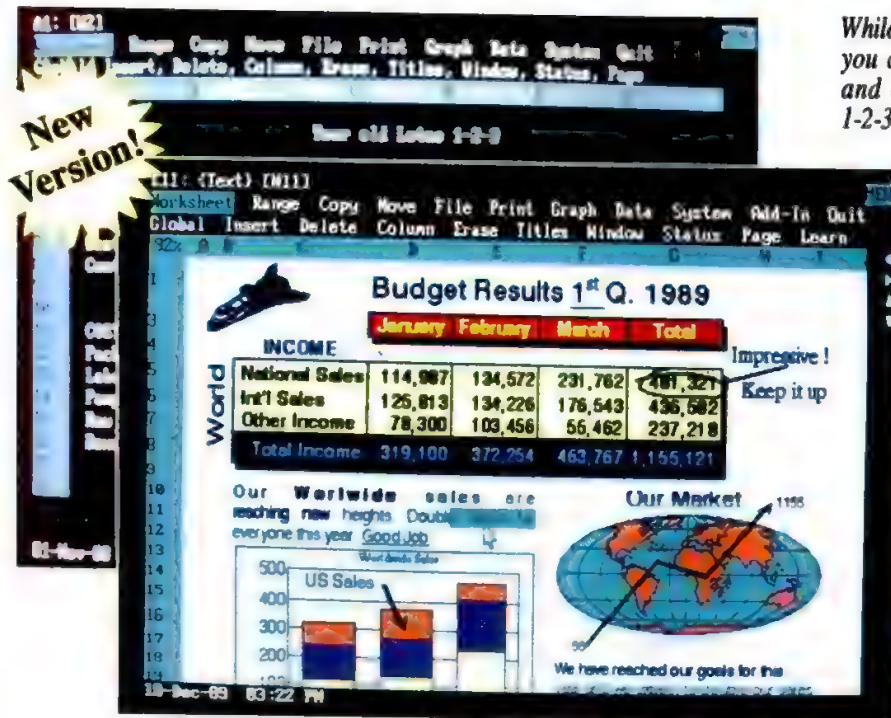
1-2-3/G offers a few graph types not available in earlier *1-2-3* releases. At

wireframe graphs. Want to make your worksheet look like a page from a *Sierra Club* mapbook or a quantum mechanics text? No problem.

GETTING TO KNOW THEM

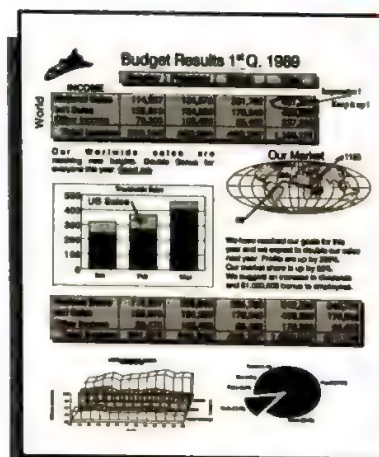
Because *Wingz* grew up without a thought of allegiance to the Lotus standard, it presents a face that will be

CONTINUES



While in IMPRESS you can edit cells and even use all 1-2-3 commands.

New For 1-2-3



What you see on your new 1-2-3 screen is what you get on paper.

Lotus 1-2-3 stays fully active in graphics mode with IMPRESS. 1-2-3 works just like before, only now you have your own customized 1-2-3 screen display and reports.

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IMPRESS from PC Publishing gives 1-2-3 true desktop publishing features that enable you to create eye-catching and persuasive worksheets.

1-2-3 Stays Fully Active

While in IMPRESS you can call all 1-2-3 commands and menus. You can also edit cells. (Unlike Allways you never need to revert back to text mode for editing cells.)

Drawing Tool Box with an Optional Mouse Support

IMPRESS brings a true graphic interface to Lotus 1-2-3. Full mouse support to call menus or open windows. Even a drawing tool box that allows you to draw any image in 1-2-3. Get a professional look quickly and easily without ever leaving 1-2-3.

Compress or Enlarge Worksheets

You can customize your 1-2-3 screen display with drawings, colors, grids and new exciting fonts. You can also zoom in and out to compress worksheets or enlarge them. See twice as many rows and columns of your worksheets on screen. No more scrolling around.

Mix Numbers, Text and Graphics

Create a professional report with numbers, graphs, images and text all on one page. Your graphs are customized. Your text automatically word wraps and is justified. You have a choice of different type styles and sizes with different fonts (3 pts. to 72 pts.). Many Bitstream Fonts included. Your images are created with the drawing tool box or imported from Freelance.

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Also Prints Sideways

Print sideways with all printers from dot matrix to laser and desk jets. Print exciting colorful reports with color printers. IMPRESS can also compress worksheets automatically so they fit any page size you want.

Customize Graphs or Forms

Graphs can be real time synchronized with your worksheet. You can also include .PIC files or Freelance files. Customize your 1-2-3 graphs with arrows, explanations, fancy titles and drawings. Draw lines, boxes, grids or even freehand to create any form or invoice from inside 1-2-3. Then fill up your forms on screen and simply print them.

Easy to Use

If you know how to use 1-2-3, you already know how to use IMPRESS, it's fast and easy. There is no learning period. IMPRESS uses 1-2-3 like menus that you are already familiar with.

Allways and 1-2-3 Rel 2.0, 2.01, & 2.2 Compatibility

If you have Allways IMPRESS imports Allways files automatically. So you can improve them, print them sideways, or simply work on them without having to toggle to text mode. IMPRESS works with 1-2-3 Rel 2.0, 2.01, & 2.2.

Technical Requirements

IMPRESS works with: 1-2-3 release 2.0, 2.01 or 2.2, DOS 2.0 or later, CGA, EGA, VGA or Hercules (No color in CGA). Supports all graphics printers that work with 1-2-3: including Dot Matrix, Desk Jet, Laser printers (Hewlett Packard, Postscript, etc.). Color printers. IMPRESS occupies 93k RAM above 1-2-3 (uses EMS if available). Many Bitstream Fonts included with package. 1-2-3 is a registered trademark of Lotus Development Corp. Allways is a registered trademark of Funk Software.

	Allways	IMPRESS
1-2-3 stays fully functional & interactive	No	Yes
Enhance & customize 1-2-3 screen display	No	Yes
Print sideways on all printers	No	Yes
Synchronized live graphs	No	Yes
See and work with more rows & columns on screen	No	Yes
Drawing tool box	No	Yes
Import Freelance images or graphs	No	Yes
Word processing capabilities	No	Yes
Customize graphs with arrows, frames, drawings	No	Yes
Full mouse support	No	Yes

"Which is better? ... IMPRESS is the clear winner. It boasts nearly every additional feature I wished for when I reviewed Allways."

5/16/89 — PC Magazine

"IMPRESS ... a clear leader worthy of an excellent score. If you like Allways, you'll love IMPRESS."

9/4/89 — Infoworld

"Works magic ... the tremendous improvement over 1-2-3's screens and reports is obvious."

3/89 — Lotus Magazine

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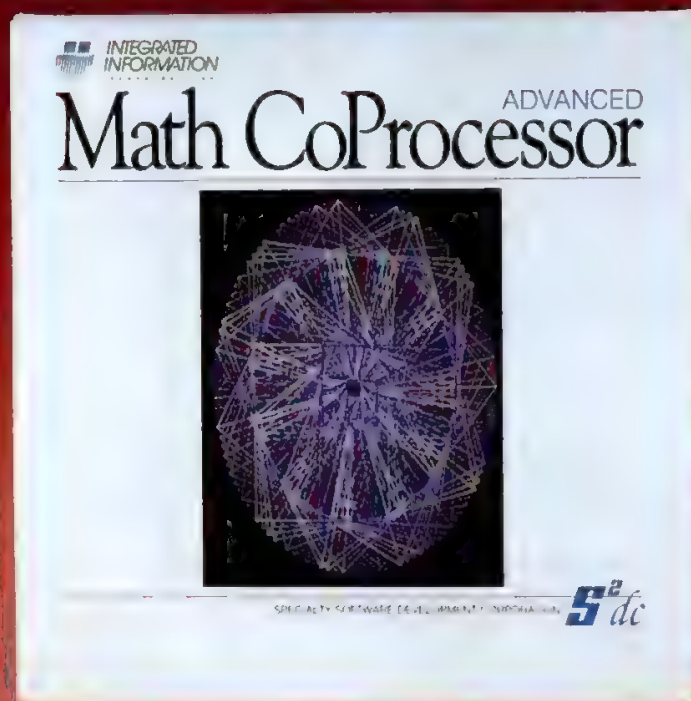
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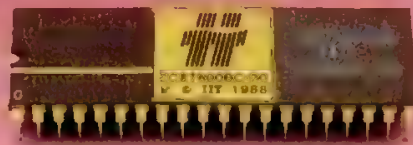
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Don H. Gross / Sewickley, Pennsylvania
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Wes Cobb / Danvers, Massachusetts



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create a single range through a stack of worksheet pages much as you'd create a range over the rows and columns in a single 2-D worksheet.

While most multipage models can be built using either approach, some may fit more naturally into one or the other. In general, if you are collecting data from different sources, the linking approach makes more sense, while the 3-D approach is best for files over which you have total control. You'll probably appreciate this flexibility most if you build and use multiworksheet models regularly. But if you do this only occasionally, the two options are similar enough to be confusing.

BETTER GRAPHICS AND DATABASE FUNCTIONS

Release 3.0 is stronger on graphics features than 2.01 or 2.2, offering line, bar, xy, stacked bar, hi-lo-close-open, area, and mixed graphs. One particularly nice touch is its ability to display a graph on the screen along with your worksheet. As with *Excel*, you can change numbers in the worksheet and watch the effect on the graph, though in 1-2-3's case you can show only one graph at a time.

Release 3.0's graphs are also better looking. Where 2.01 crowds a bar graph by butting the bars against the frame, 3.0 leaves a welcome space. (Release 2.2 offers similar improvements in graphics, but 3.0 does a better job.)

Just as welcome is the fact that Release 3.0 integrates graph printing functions into its menus, doing away with the separate

CONTINUED

completely unfamiliar to non-Macintosh users. Those who shied away from *Excel* because its command style was too different from Lotus 1-2-3's are not likely to be drawn to *Wingz*.

Users of 1-2-3's Release 2.2 and 3.0 will find that their keyboard habits serve well in 1-2-3/G. Though the menus are now SAA-compliant, they remain keystroke-compatible with the celebrated two-line system engineered by Mitch Kapor nearly a decade ago: the slash, F10, or the SAA-decreed Alt keys all work.

Indeed, the biggest obstacle presented by the new interface is probably the need to invoke macros with Ctrl instead of Alt. Except for the addition of a few advanced commands for handling dialog boxes, the macro language is identical to that of Release 3.

File linking is common to both the two-dimensional *Wingz* (whose gigantic spreadsheets can span up to 32,768 rows by 32,768 columns) and the three-dimensional 1-2-3/G (which allows up to 256 pages per worksheet file). With the help of DataLens drivers (supplied by Lotus as well as by third-party vendors), 1-2-3/G should eventually make powerful connections with outside data-management systems.

Although at first it may look like a simple transplant of Release 3, 1-2-3/G goes beyond that package in some important ways. In addition to borrowing a few ideas from *Excel* (like multiple-range selections, a Paste Special command, and user-defined data formats), it offers dynamic linking to other PM programs via DDE (Dynamic Data Exchange). Lotus's technology-sharing arrangement with WordPerfect Corp. should result in easy data exchange be-

tween 1-2-3/G and the forthcoming PM version of *WordPerfect*.

1-2-3/G also includes an enormously powerful program called Solver. Working as a background thread, Solver solves both linear and nonlinear optimization problems involving an apparently unlimited number of variable cells and constraint formulas. Lotus says that theoretically, the complexity of the problems you can assign to Solver has no limit other than the amount of memory and time you have available.

**Users of 1-2-3's
Release 2.2 and
3.0 will find
that their keyboard
habits serve
well in 1-2-3/G.**

WINGING IT

In addition to its graphics, the strongest attraction of *Wingz* is HyperScript, Informix's own English-like programming language. A much more ambitious programming system than any other spreadsheet's macro language, HyperScript in-

cludes nearly a thousand statements and functions for manipulating every logical, visual, and aural aspect of *Wingz*. It also allows you to link in C routines for even greater flexibility. HyperScript also comes with its own editor and compiler—and a separate manual that's larger than the spreadsheet reference.

While *Wingz* reads and writes .WK1 files, it claims no further 1-2-3 compatibility. Without great prospects for seducing the longtime Lotus devotee, Informix hopes to woo a different breed of spreadsheet user—one who values presentation and programmability above all else.

If and when the Great Migration to OS/2 begins in earnest, Microsoft will find itself ably challenged on two distinct fronts. The buttoned-down spreadsheet user may find 1-2-3/G easier to use, while the adventurous and graphics-minded may decide there's more to work with in *Wingz*. ■

FACT FILE



Lotus 1-2-3, Release 3.0

Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142, (617) 577-8500.

List Price: \$595 (includes both DOS and OS/2 versions).

Network server version: \$695 plus \$395 per node; upgrade from Release 2.2, \$75; from any prior release, \$150.

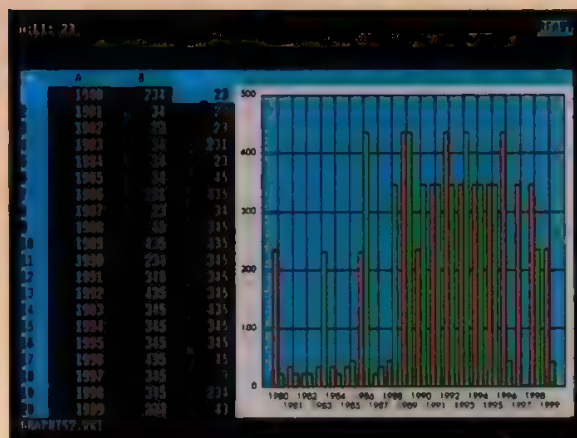
Requires: 286- or 386-based PC, DOS 3.0 or later. DOS version requires at least 1MB of extended memory in RAM; OS/2 version requires 3MB RAM (4MB recommended).

In Short: Release 3.0 offers sophisticated linking and 3-D features, visually attractive graphics, and robust links to external databases. But it's complex to use, lacking some amenities, and, without *Altways*, pedestrian in output. It's a good start, but it's not yet finished.



CIRCLE 420 ON READER SERVICE CARD

Using a graph window that can be as wide as you like, 1-2-3 Release 3.0 can show a graph on the same screen as your worksheet. Changes to the numbers or to the graph settings are reflected immediately.



PrintGraph program. Unfortunately, because *Allways* does not run under Release 3.0 (it must be rewritten to the requirements of 3.0's new add-in scheme), you can't get the stunning output you can get from Release 2.2. Lotus promises to add *Allways* to Release 3.0 as soon as it becomes available, but until then, you're stuck with boring, monospaced type and dashes, and you'll have no way to print graphs and worksheets side by side.

A significant advance over the Release 2 standard is Release 3.0's vastly expanded database capabilities. Its Data External commands, with the appropriate DataLens drivers, let you write and retrieve data to and from external database files from within the 1-2-3 environment. As of this writing, drivers were available only for *dBASE III* and *III Plus* files, but a Lotus spokesman says that additional drivers are currently being developed both by Lotus and by key database software developers.

1-2-3, Release 3.0's titled "Perspective" view lets you see up to three spreadsheet pages at once on the screen. Additional letters designate the page in the cell reference. You can hold up to 256 spreadsheets in RAM at once.

STRAINS AND GAINS

Release 3.0 incorporates a wealth of other new features, including an undo command and many other small enhancements. It is available in a network server version and has network controls to ensure file integrity in a multiuser environment. Its new macro learn mode and its ability to store macros on any worksheet open in memory are also welcome.

But the sheer number of new features that Release 3.0 incorporates puts a severe strain on menu logic. With over 200 new choices on the menus, the branches have grown so much that the tree may be about to fall over from its own weight. It doesn't help that some menu choices—color, for example—mean different things in different parts of the program. The setting sheets in 2.2 go a long way towards solving this problem, and it's unfortunate that Lotus chose not to incorporate them in 3.0.

Release 3.0 offers well-implemented

file-linking and 3-D features, robust external database capabilities, and much-improved graphics. But its clumsy menu structure and its limitations on high-quality output can't be ignored. Written in C for portability, it is also generally slower than 2.01 or 2.2. While die-hard 1-2-3 users may not mind, these flaws give the less committed good reasons to pass up the product.

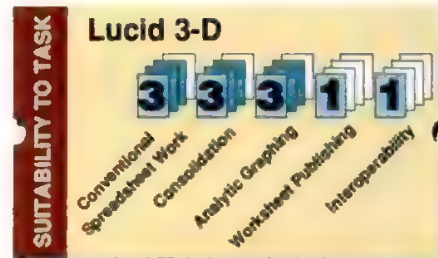
Lucid 3-D

by Henry Ford and others

Working with DacEasy's *Lucid 3-D* is like practicing sleight of hand. A press of a hot-key brings this memory-resident software leaping to the foreground. There, you can jot down some numbers, pull in information from the application you just left, start a graph, and then stuff *Lucid 3-D* back up your sleeve.

What makes this conjuring so impressive is that the program occupies only 140K of conventional RAM and costs a mere \$99. Yet it works with up to 8MB of total memory—conventional and expanded—so you'll have ample room for the nine windows you're allowed to open, even when they contain large and complex worksheets.

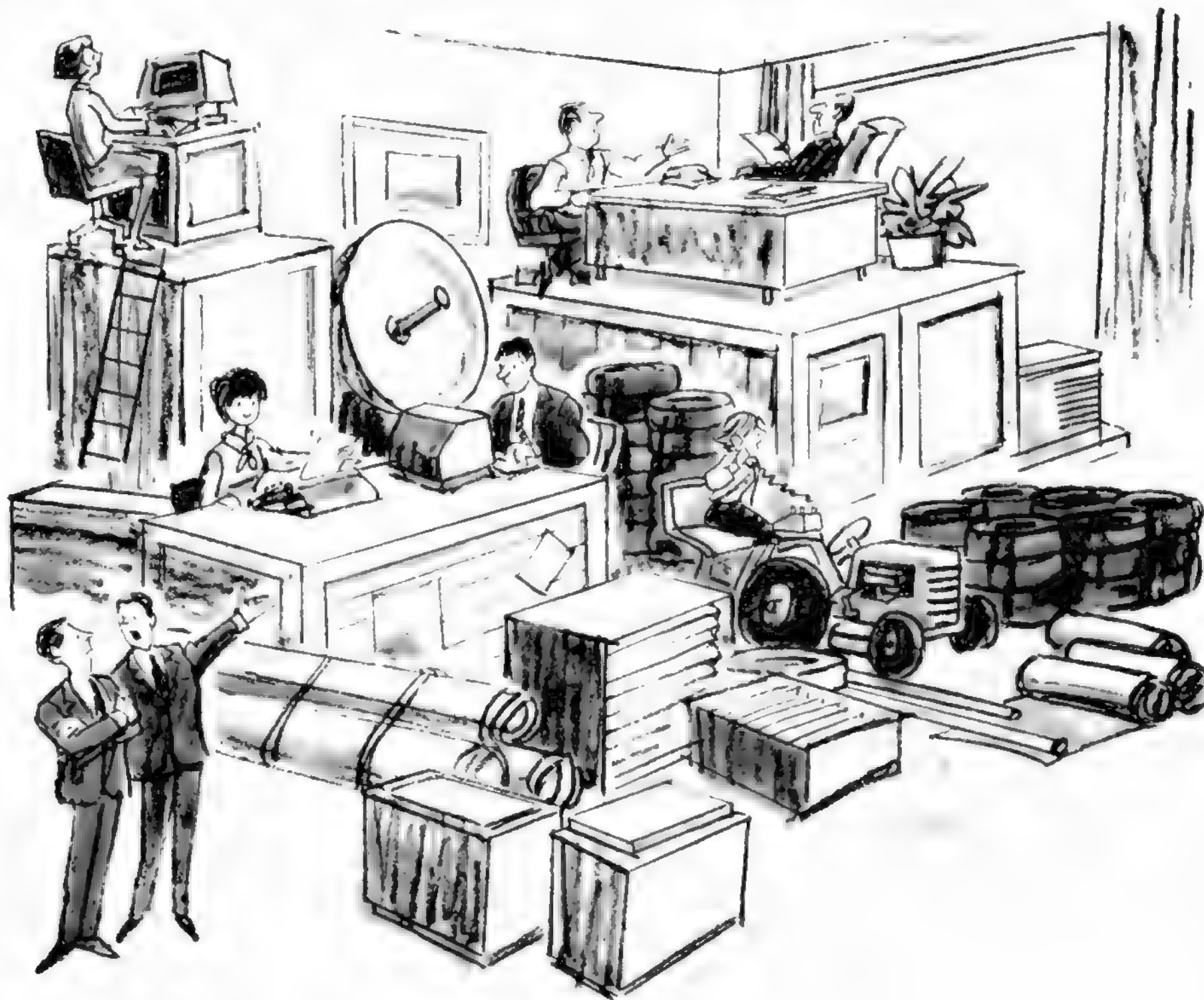
By default, *Lucid* (which can be run as a standalone application) gives you a 63K work area, but you can allocate as much or as little memory as you want by using the /K parameter at the DOS prompt. Command line parameters control whether you load the graphics and file-translation utilities, as well as letting you edit the configuration file, load a macro, or unload the pro-



gram. While all this is a little awkward, it does help conserve RAM while customizing *Lucid* to your needs.

PELLUCID LUCID

The interface in *Lucid* resembles its name: it's clear, thoughtful, and appealing. The worksheet windows can be resized, moved, zoomed, or split into simulta-



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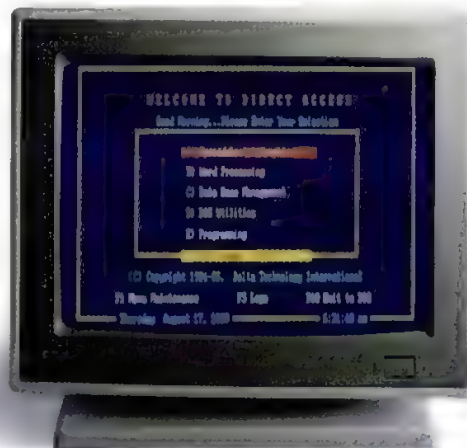


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COVER STORY SPREADSHEETS

neously scrolling halves. *Lucid 3-D's* well-designed stacking menus can be invoked either with the F10 key or, like 1-2-3, with the slash key. The program's excellent mouse support makes your work even easier; window controls and the pop-up calculator are represented by icons, and you can mark ranges, scroll, turn switches, and leap across the sheet without touching the keyboard. You can even enter letters and numbers with a mouse if you're willing to pick them one by one from a pop-up label box.

Lucid's cleverly designed clipboard not only lets you copy and move ranges or save them into separate files, but also allows you to copy them to and from an underlying program. A notepad that holds up to 16K of text (about eight pages) lets you attach memos or disk-based note files to individual cells. The notepad window can be resized or moved, and you can set margins, number pages, and add headers and footers to your notes.

While not a true 3-D spreadsheet, *Lucid* is adept at creating links between worksheets. This lets you break your models into manageable chunks and also helps you get around the 254-column limit. *Lucid* can link both individual cells and ranges between worksheets. When the cursor is on a linked cell, the gray Plus and Minus keys let you move back and forth between the worksheets very easily. The program also reads and writes DacEasy Accounting files directly.

POWERFUL MACROS AND GRAPHICS

Lucid's macros are quite powerful. You can record your keystrokes to build macros, or write and edit them in the notepad

FACT FILE

Lucid 3-D

DacEasy Inc., 17950 Preston Rd. #800, Dallas, TX 75252; (800) 877-8088, (214) 248-0205.

List Price: \$99; upgrade from previous versions of *Lucid*, \$35.

Requires: 384K RAM, two disk drives (512K and hard disk recommended), DOS 2.1 or later. Mouse optional.

In Short: Capable of running either standalone or memory resident, *Lucid 3-D* offers a clean, easy-to-use windowing interface with terrific mouse support, plus good macros, speedy performance, and nice graphics—all at a very low price. It's not as powerful as many of its competitors, especially when it comes to formulas, but it's an unbeatable bargain if your needs are modest.

CIRCLE 421 ON READER SERVICE CARD

and then compile them. Macros use English-like phrases and can be nested up to ten levels deep. You can also define your own functions, each with up to nine arguments.

The graphics module, which must be loaded separately, is another one of the joys of *Lucid*. You can view most of the ten basic graph types—bar, pie, and so forth—horizontally as well as vertically; since you can also switch rows and columns, you have a total of 37 different views. Creating and modifying graphs is extremely easy. Data labels are generated automatically, and you have good flexibility in the placement of headers, footers, and custom legends.

Lucid has no database functions and

isn't completely compatible with 1-2-3 (it won't, for instance, read or write Lotus macros). But its pleasing design and wealth of capabilities, not to mention its low price, make the program quite a bargain. Unconventional though it may be, it is an excellent choice.

Microsoft Excel

by Bill O'Brien

If we are really entering a new, graphical age, Microsoft would certainly like the dominant spreadsheet to be *Excel*. And that might not be a bad thing. With solid spreadsheet and charting components and a comprehensive macro language integrated into a powerful graphical environment, *Excel* is no more "just a spreadsheet" than a Ferrari or a Porsche is "just a car."

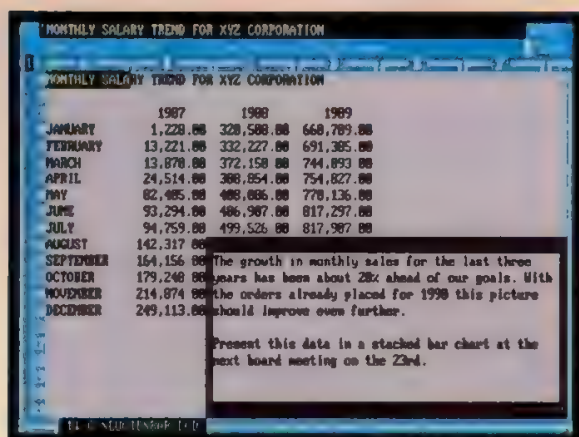
Excel comes in versions for *Microsoft Windows* and for the OS/2 Presentation Manager (each sells for \$495), as well as



for the Macintosh. With the exception of a data consolidation feature for grouping dissimilar ranges in the OS/2 version, there is little functional difference between the two PC versions, and all three versions are file compatible—a unique advantage for mixed-platform installations. Microsoft claims that the OS/2 version has some advantage in speed, but if this is true, much of it seems to be absorbed by the OS/2 dreadnought. The common user interface and command structure makes migration a painless trip, but it's a pity that Microsoft did not take better advantage of OS/2's multithreading and background processing features to boost performance, as Aldus did with *PageMaker for Presentation Manager*.

MORE THAN A PRETTY FACE

Beyond its visual trappings, *Excel* is a rather typical spreadsheet, though one with enough statistical and mathematical functions to rival or best nearly all of its competitors. But the rich functionality of its graphical environment helps a great



Lucid 3-D's useful notepad lets you attach a note up to 16K in length to any cell or reference any ASCII text file on disk. You can size and move the notepad window just like any other *Lucid* window.

deal in overcoming the tedious side of spreadsheet work. Copying the contents of a range of cells to another range, for instance, is no more complex than selecting the origin and destination cells and pressing a few keys. To mark a range, you simply click on the cell where you want it to begin, hold down the shift key, and then click again where you want it to end.

Granted, if you are new to *Windows*, your first few *Excel* sessions may be spent awkwardly clutching the mouse with one hand, stabbing at menus and options, as you timidly enter data with the other. But with practice and repetition, the rational key assignments in *Excel*'s SAA-compliant menus will let you concentrate on the work at hand.

Excel's file-linking capabilities aren't as flexible as the three-dimensional schemes of some of its competitors. While *Excel* is less adept at consolidating similar worksheets than is *1-2-3*, Release 3.0, its multiwindow graphical environment makes this distinction almost irrelevant in many instances, especially when the worksheets are dissimilar. Linking cells and

ranges becomes simpler when you can point at them with the mouse, and you can group interrelated spreadsheets together in a workspace that can be saved and then retrieved as a unit.

As with its spreadsheet features, the real strength of *Excel*'s database functions lies not only in their intrinsic power but in their integration. You don't fully realize the strength of the Extract function, for example, until you need to create separate reports to describe various aspects of a larger master sheet. Rather than forcing you to manipulate a sizable document and then define the formatting parameters for a limited area, *Excel* lets you simply extract the data into a new sheet. If you choose to retain the new information as linked formulas, your updates to the master sheet will be reflected in the subsidiary sheets.

Auditing is another one of *Excel*'s strong points. You can create a note for each cell in order to document its origins or functions, and the program's Show Info option displays the formulas, dependen-

cies, and notes for the currently selected cell. You can print the notes with the worksheet if you choose.

CHARTING YOUR DATA

Purists will certainly contest Microsoft's use of the word "charts" as a description of *Excel*'s graphing facilities. But even though these facilities lack the advanced features of a dedicated charting package, they are sufficient to satisfy most spreadsheet users. A variety of graph types are available through the Gallery menu, running the gamut from simple line charts to pie, bar, and column charts and to scattergrams. You can use as many data sets in a single graph as visual clarity will permit. Your graphs can also be enhanced with resizable arrows, and text labels are available in the full range of typefaces that *Excel* supports, as well.

Because *Excel* runs under *Windows*, importing data into a graph is as simple as copying and then pasting the selected ranges into the *Windows* Clipboard. Graphs can be overlapped in the order they are imported, and you can change this order to bring background values to the forefront whenever you need to.

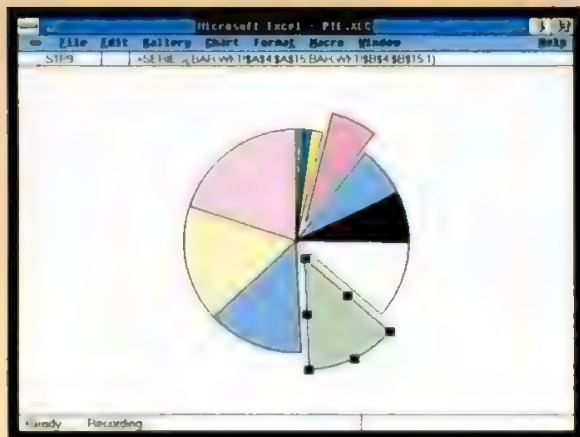
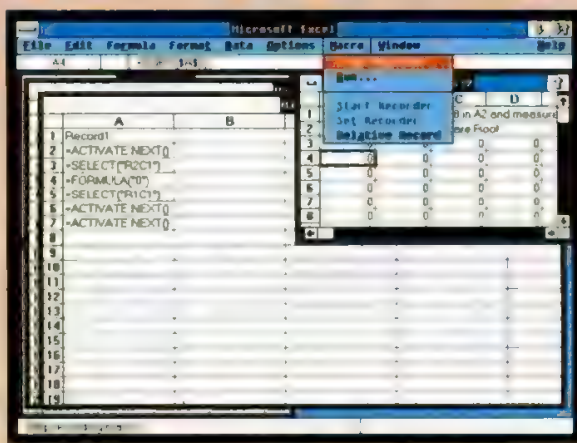
Excel is justly renowned for its outstanding worksheet publishing facilities, though with the advent of *Quattro Pro* it's no longer alone in this regard. Credit for this actually goes to *Windows* for its extremely flexible printer and font support, but *Excel* borrows handily from them. Portrait or landscape printing is no more complicated than making a selection from the printer setup menu, while its preview mode (with full-page zoom) helps ensure that your final output is what you intended it to be.

PROGRAMMING AGILITY

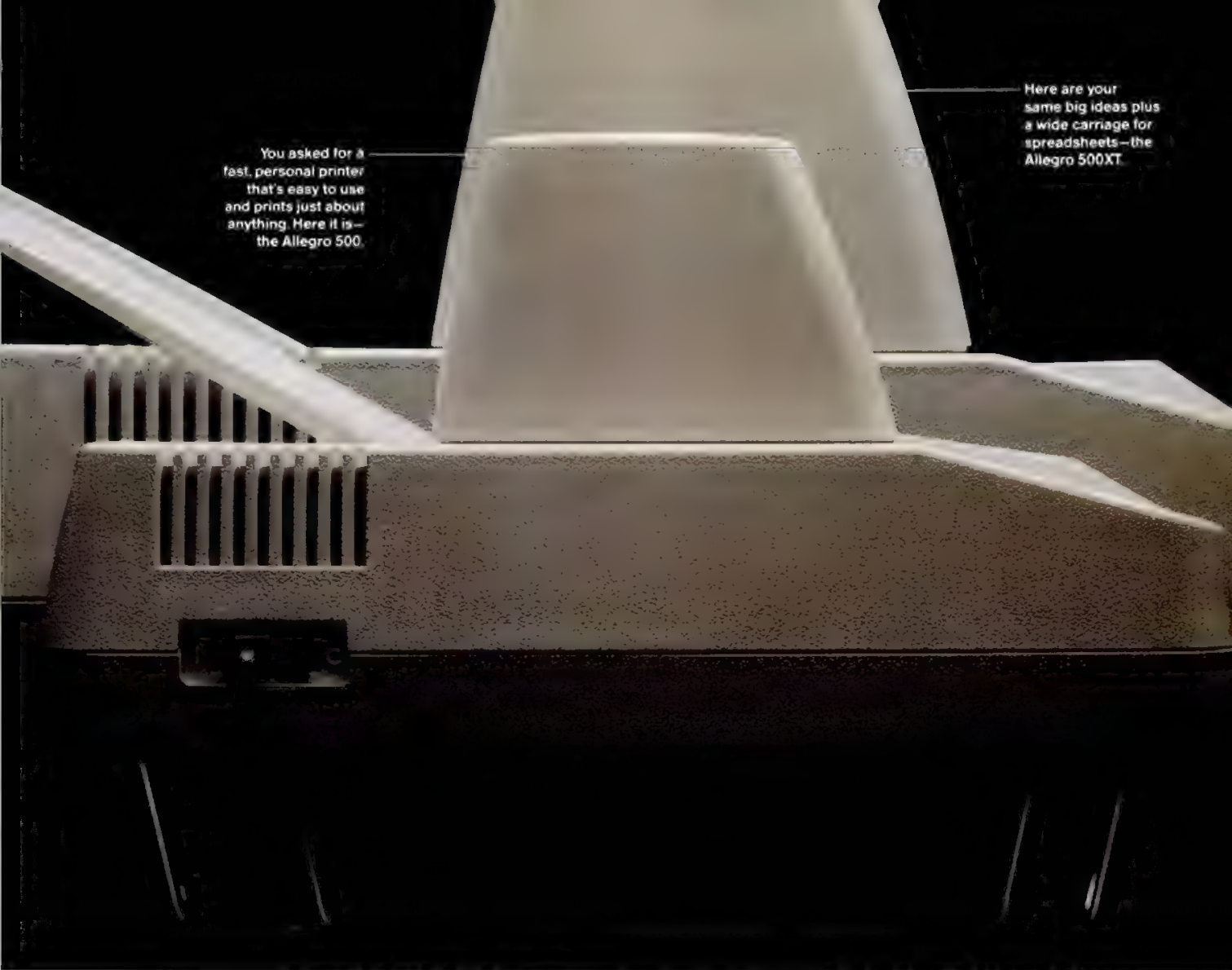
Few spreadsheets offer you as complete a programming language as *Excel*. *Excel*'s macro language goes well beyond the simple manipulation of spreadsheet functions, allowing you to create fully functional applications complete with modified menus and restricted data-entry types.

While macros are traditionally cryptic and difficult to learn, *Excel*'s macro commands logically follow its menu functions. Its excellent macro recorder will furnish you with a functioning transcript of anything you do in the program, a major help when you're automating repetitive tasks. Because *Excel* maintains a separate macro sheet, editing is simpler than if it were mixed with live data; you use the cutting

Microsoft *Excel*'s macro functions use the same notation as the program's standard functions. A macro recorder lets you capture your activities to a macro sheet to be replayed or modified later.



You can link worksheet data dynamically to *Microsoft Excel*'s graphs. You have a lot of control over the appearance of the graph and can insert text annotations simply by typing.



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FACT FILE

EDITOR'S CHOICE

Microsoft Excel

Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; (800) 426-9400, (206) 882-8088.

List Price: Windows or OS/2 version, \$495. Upgrade from Windows version to OS/2, \$50; upgrade from any previous Windows version, \$35. Network license (Windows version only): server and one node, \$250.

Requires: Excel for Windows: 640K RAM, Microsoft Windows 2.1 or later or DOS 3.0 or later. Excel for OS/2: 2.5MB RAM, OS/2 1.1 or later, 286- or 386-based PC. Hard disk required; mouse recommended.

In Short: Though it's no longer miles out in front of the competition, Microsoft Excel is still one of the best spreadsheets on the market. Full-featured spreadsheet, database, and charting functions buttressed by a powerful macro language and superb publishing support, all closely integrated in the Windows environment, make it an excellent choice for high-end and mission-critical uses.

CIRCLE 417 ON READER SERVICE CARD



and pasting facilities available throughout the program.

You can even create custom functions, defining simple or complex data processes in a series of formulas whose complexities are embedded in the macros. Excel appends these macros to its list of functions; to use one, you simply supply the function name and its list of arguments, just as you would with one of Excel's predefined functions.

Excel's graphics environment does impose a slight penalty in speed and its system demands are substantial: although Microsoft recommends only an AT-class machine, a 20-MHz or faster computer with 2MB (for Windows) or 4MB (for OS/2) is preferred. But Excel's agility at handling the multiplicity of day-to-day spreadsheet problems may make it the fastest way to get your work done. Obviously, Excel is not the product to use on a low-end system, but if your spreadsheet demands are great, it may be your best choice.

PlanPerfect

by Bruce Brown

Though overshadowed by its more celebrated cousin, WordPerfect Corp.'s *PlanPerfect* may well be almost as good a spreadsheet as *WordPerfect* is a word pro-

cessor. The \$495 program is as feature-rich as *1-2-3* but also works comfortably with *WordPerfect*, sports admirable graphics printing facilities, and has the significant advantage of WordPerfect Corp.'s universally esteemed product support.

PlanPerfect admirably juggles its three interfaces. *WordPerfect* users will find *PlanPerfect*'s command interface familiar: both use similar function-key combinations. Yet Lotus users will find that most (though not all) of the familiar *1-2-3* command sequences work. And anyone crossing over from programs with single-key horizontal or pull-down menus should also find it easy to get used to.

PlanPerfect's two-dimensional worksheets can be linked in memory or on disk through file-linking expressions stored in the destination worksheet. The program can be configured to update the links automatically whenever you load the destination file, or you can perform manual updates. You can keep two worksheets in memory at once; a clipboard makes it convenient to copy ranges from one sheet to another.

Data-handling features are adequate. You can sort by rows or columns on up to ten keys. The Data Forms feature lets you set up a filter, and you can view, extract, or delete records using *PlanPerfect*'s data querying functions. The process (which resembles but does not exactly mimic *1-2-3*'s), is a little awkward but otherwise functional.

You can create nine standard types of charts, including pie, bar, area, line, scatter, and hi-lo, which can be decorated with a limited range of fonts. Graphs can't be



displayed on the same screen with spreadsheets, but you can bring both graph and spreadsheet into a *WordPerfect* 5.0 document file and print them together. Even if you don't use *WordPerfect*, you can exercise a good deal of control over printing: *PlanPerfect* offers a full-page print preview mode and lets you use up to 32 fonts per spreadsheet.

PERFECT (?) MACROS

PlanPerfect supports two types of macros: cell macros, which are entered in a single worksheet, and file macros, which are saved in separate files and can be used from within any worksheet. You can use eight-character names for your macros, or you can assign them to an Alt key as you do in *1-2-3* (though in the latter instance, you must be careful not to generate a conflict between cell macros and file macros). Macros can also be used to create user-defined functions.

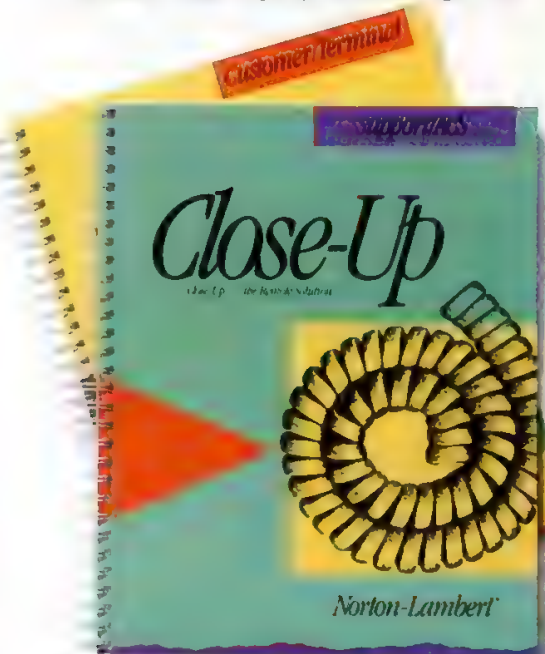
PlanPerfect reads *1-2-3* files, bringing in the data and most of the functions with no problem. A conversion utility is supposed to handle the more demanding job of translating *1-2-3* macros, but it's not always successful. Although unrecognized macros are identified so that you can edit or replace them, this half measure is not a great time-saver. *PlanPerfect* can also im-

When sorting columns or rows in *PlanPerfect*, you can set as many as ten sort keys, each in ascending or descending order.



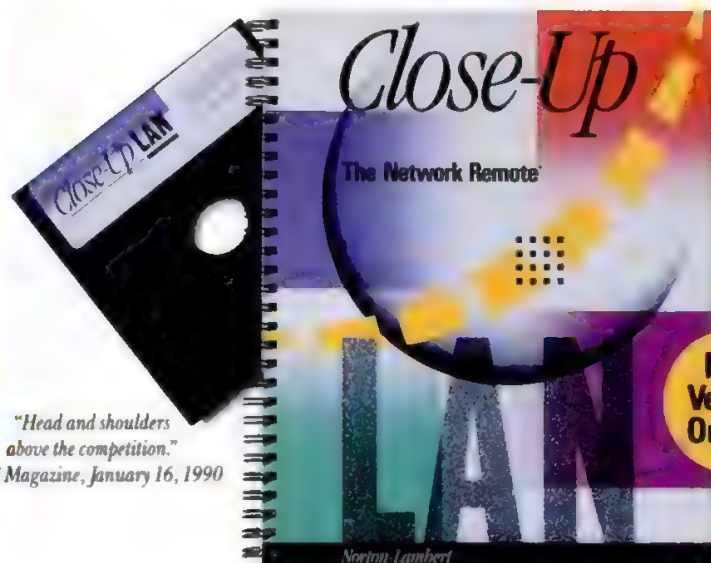
"Leader of the Pack"

— PC Magazine, October 31, 1989



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Modem Remote



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FACT FILE



PlanPerfect
WordPerfect Corp.,
1555 N. Technology
Way, Orem, UT 84057;
(801) 225-5000
List Price: \$495.

Requires: 384K RAM
(hard disk
recommended), DOS
2.0 or later.

In Short: If you're committed to a WordPerfect environment, PlanPerfect's interface and data compatibility make it a logical choice. But it's not enough of an improvement over 1-2-3 to induce corporate users to switch, and its high price is an additional deterrent.

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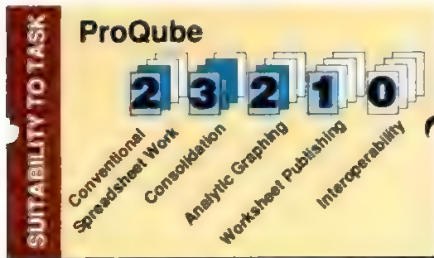
port dBASE files, comma-separated variables, and straight ASCII text files.

For pure function, PlanPerfect emerges as a fine choice in the spreadsheet arena. But its advantages over 1-2-3 aren't great enough, nor is its cost low enough, to make most corporate users choose it over Lotus's standard. It might be a good choice for offices committed to the WordPerfect environment, but not for many others.

ProQube

by Bruce Brown

FormalSoft's \$99 ProQube doesn't even try to be a Lotus 1-2-3 knock-off. Its command set does not mirror 1-2-3's, and, while you can import Lotus worksheets, their macros won't be converted. This may disappoint anyone who's a stickler for compatibility, but ProQube's virtues—a congenial user interface, fine macro and command languages, and a facile ability to



look at three-dimensional workspace data from various viewpoints—may impress you regardless.

ProQube's distinctive method of operation revolves around successive commands or options cascading down the screen from the top-line menu. The advantage to this system is that you'll never get

lost in it; the flip side is that as the menu cascades further down, more of the on-screen worksheet gets covered up.

The program's worksheet dimensions are symmetrical—512 columns by 512 rows by 512 pages. That's twice as many columns as 1-2-3 offers, but only 1/16 the number of 1-2-3's 8,192 rows. If you import a 1-2-3 worksheet with more than 512 rows, the extras are simply cut off. But ProQube's three-dimensional design is intended to let you split larger worksheets into pages for easier management of data. For example, you might use a page for each month in a budget, with an additional consolidation page to sum them all up. It's simple to move between the pages, and ProQube's functions and formatting commands work across these three-dimensional ranges. As you'd expect, all the formulas in the 3-D worksheet are updated automatically when you recalculate; links to external files are updated when you load the spreadsheet.

A RANGE OF PERSPECTIVES

ProQube's unique WorkQube View function lets you easily switch among front, back, top, bottom, left, and right views of the 3-D workspace. You can extract different "slices" of data depending on your orientation and cell location. For example, one slice might show you a single budget item across all months in the year, while another would let you see the values for all budget accounts in a particular month.

This ability to examine data from different perspectives lends itself to analysis of multiple variables in lab settings as well as in more conventional business settings. You can print any WorkQube View (though the output lacks font support and WYSIWYG preview), and you can also graph the data. But the penalty of this three-dimensional flexibility shows up in the performance: many of ProQube's functions, including worksheet recalculations, are slow.

Over 100 math, trigonometric, statistical, financial, date, logical, string, macro, and data functions are included. The 3-D data functions, especially, are a nice feature, since they let you keep lookup tables on their own pages rather than tucking them away somewhere on the same page as the data. ProQube's database abilities are weak because of its 512-row limit and its lack of database query commands. But imported dBASE files with more than 512



PERFORMANCE TESTS:
FILE-LINKING SPREADSHEET

Microsoft Excel and Quattro Pro take the prize for overall best performance, though Lucid 3-D, SmartWare II, and Lotus 1-2-3 Release 2.2 do best on individual tests. Lotus 1-2-3 Release 3.0's mandatory background recalc and disk-intensive link refresh methods impose a heavy performance penalty.

We tested the spreadsheets reviewed in this issue on a Compaq Deskpro 386 running at 25 MHz, equipped with 4MB of RAM and an Intel 80387 math coprocessor. We used Compaq DOS 3.31 as the operating system for the DOS products; the OS/2 products were tested under OS/2, Version 1.2.

We contacted the vendors of each product to find out the recommended amount of expanded memory (under Compaq's CEMM driver) or extended memory (under 80386 real and protected modes) to use with their products. In most cases, the vendors opted for 1MB of expanded memory in addition to 640K of conventional memory. The exceptions were Lotus 1-2-3 Release 3.0 (DOS version) and Quattro Pro, which used extended memory, and SmartWare II, which used only the 640K of conventional memory.

The five PC Labs performance tests for spreadsheets were timed manually with a stopwatch. The clock was started at the final keystroke of the command sequence that began the test and was stopped when the system finished processing completely, whether in the foreground or the background.

The tests themselves were created in Lotus 1-2-3 Release 2.2 and imported into the other packages. Formula adjustments were made as necessary to account for imperfect importing of .WK1 files. Before testing began, each worksheet was saved in the native format of the spreadsheet package to be tested and then reloaded in that format. In all cases, the packages were set for manual recalculation.

The values for memory and disk space usage were acquired from each program's status or environment report.

The Mathematical Worksheet

Recalculation test measures the time a program takes to calculate a worksheet containing 1,456 mathematical functions (square root, addition, subtraction, multiplication, division, and @SUM).

The Loan Recalculation test calculates the monthly payment and displays the amortization schedule for a 30-year mortgage with a given loan principal. All columns except the payment and month number require recalculation.

The Internal Rate of Return test calculates the Net Present Value (NPV) and Internal Rate of Return (IRR) for 253 different ten-year cash flows. During the test, NPV figures remain constant, but we forced the IRR function into recalculation by changing the iteration guess factor. Programs that use intelligent algorithms will recognize this distinction, while those that don't must recalculate the NPV figures, slowing their times.

The Database Sort test times the sorting of a 995-record database containing text and values. The sort uses both primary and secondary keys from the ten possible fields, and no recalculations are required.

ProQube handles a maximum of 512 rows per worksheet, so the database test for this package was run with 507 records.

Framework III allows only one sort key, so the spreadsheet was sorted twice, in keeping with the vendor's procedure for performing secondary sorts. The two times were added together to produce this score.

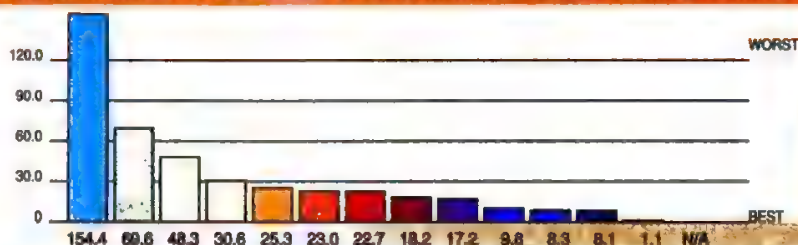
The Link Refresh test evaluates the sophistication of the program's linking search algorithm. Five columns by 200 rows of an external reference worksheet were linked to the corresponding cells in a link worksheet, and we measured how long the package took to refresh the links completely. The reference worksheet was kept on-disk when possible; otherwise it was held in memory. Long times typically indicate packages that must poll the disk to find the linked values on the reference sheet, even if no linked values have changed.

N/A—Not applicable:

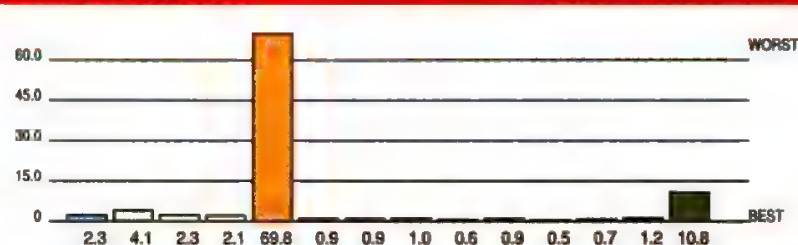
Enable/OA could not load or run the mathematical recalculation file because of its memory management restrictions.

ProQube could not perform a link refresh.

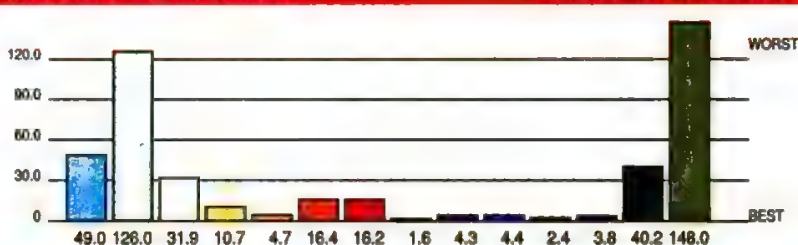
Mathematical Worksheet Recalculation Elapsed Time (seconds)



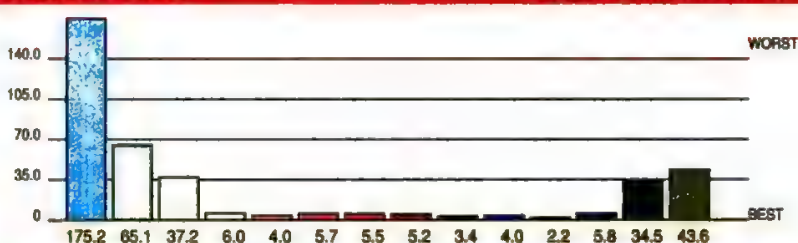
Loan Recalculation Elapsed Time (seconds)



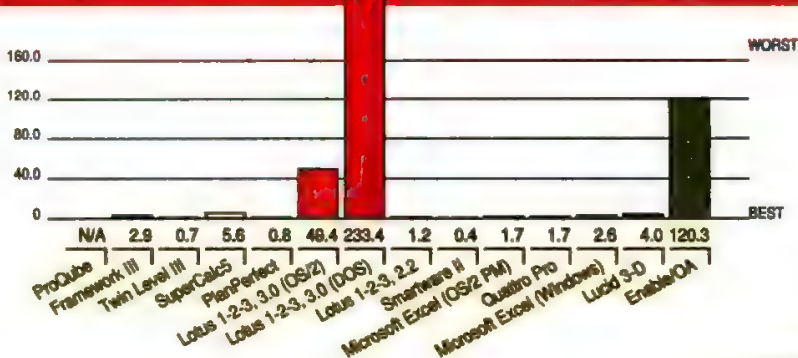
Internal Rate of Return Elapsed Time (seconds)



Database Sort Elapsed Time (seconds)



Link Refresh Elapsed Time (seconds)



CONTINUES



PERFORMANCE TESTS: FILE-LINKING SPREADSHEETS

The **Load from Disk** test measures the time it takes to load the Mathematical Worksheet Recalculation file from disk in the program's native file format.

The **Save to Disk** test measures the time it takes to write the same test file to disk in the program's native file format.

Memory Used reports the amount of RAM used when the spreadsheet program is loaded and active but does not contain worksheets. Key factors here are the size of the program and its ability to use overlays or virtual memory to swap modules in or out of RAM as needed. Smaller values generally mean the program can handle larger spreadsheets.

Worksheet Size reports the amount of RAM needed to contain the Mathematical Worksheet Recalculation file. If this is smaller than the size of the file on disk (see File Size), it may indicate that the spreadsheet uses tokenization to conserve memory space, which in turn permits you to use larger spreadsheets and makes more RAM available for overhead operations.

File Size reports the size of the Mathematical Worksheet Recalculation file written to disk in each program's native file format. Use this number to determine the effectiveness of memory-handling and virtual-storage techniques by comparing it with the result found under Memory Used. In most cases, each package tokenized the saved spreadsheet to conserve disk space.

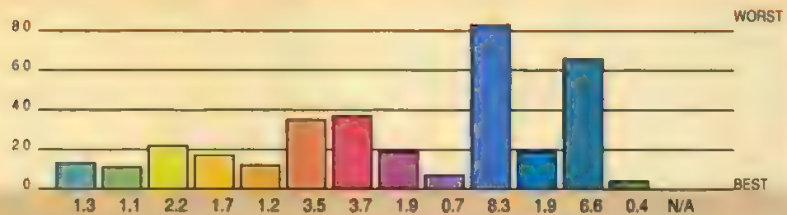
N/A—Not applicable:

Enable/OA could not load or run the mathematical recalculation file because of its memory management restrictions; hence, it could not perform any tests involving that file (Load from Disk, Save to Disk, Worksheet Size, and File Size).

Memory Used does not apply to programs running under OS/2, a virtual operating system that allocates memory according to system demand.

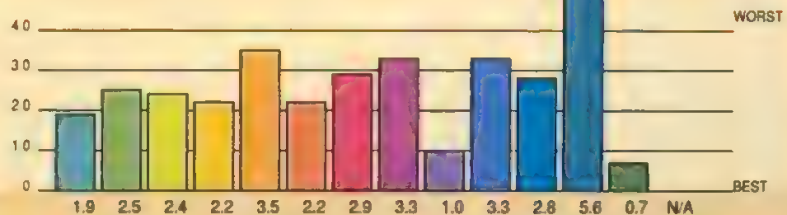
Load from Disk

Elapsed Time (seconds)



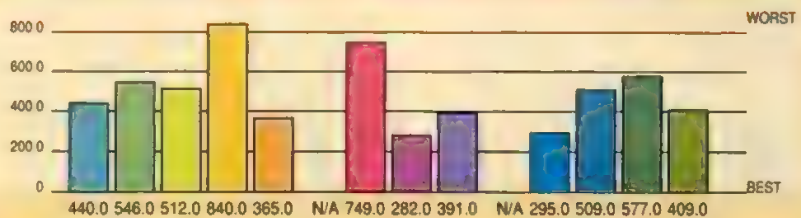
Save to Disk

Elapsed Time (seconds)



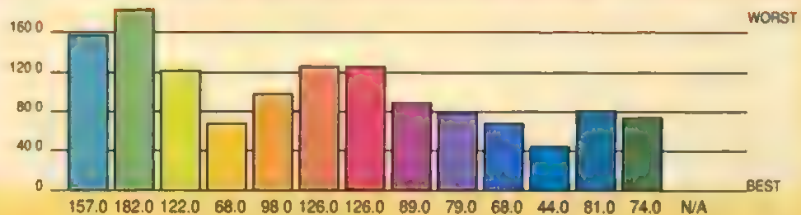
Memory Used

(kilobytes)



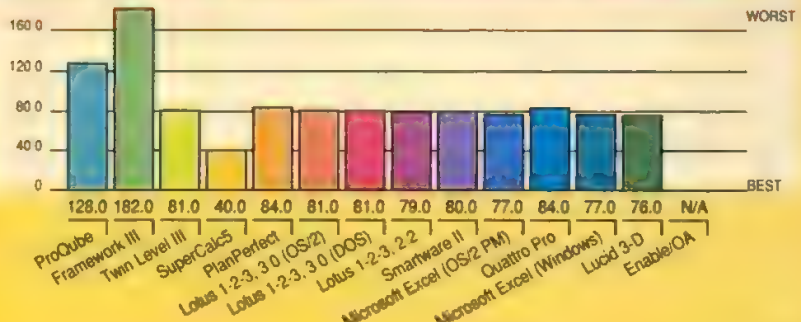
Worksheet Size

(kilobytes)



File Size

(kilobytes)



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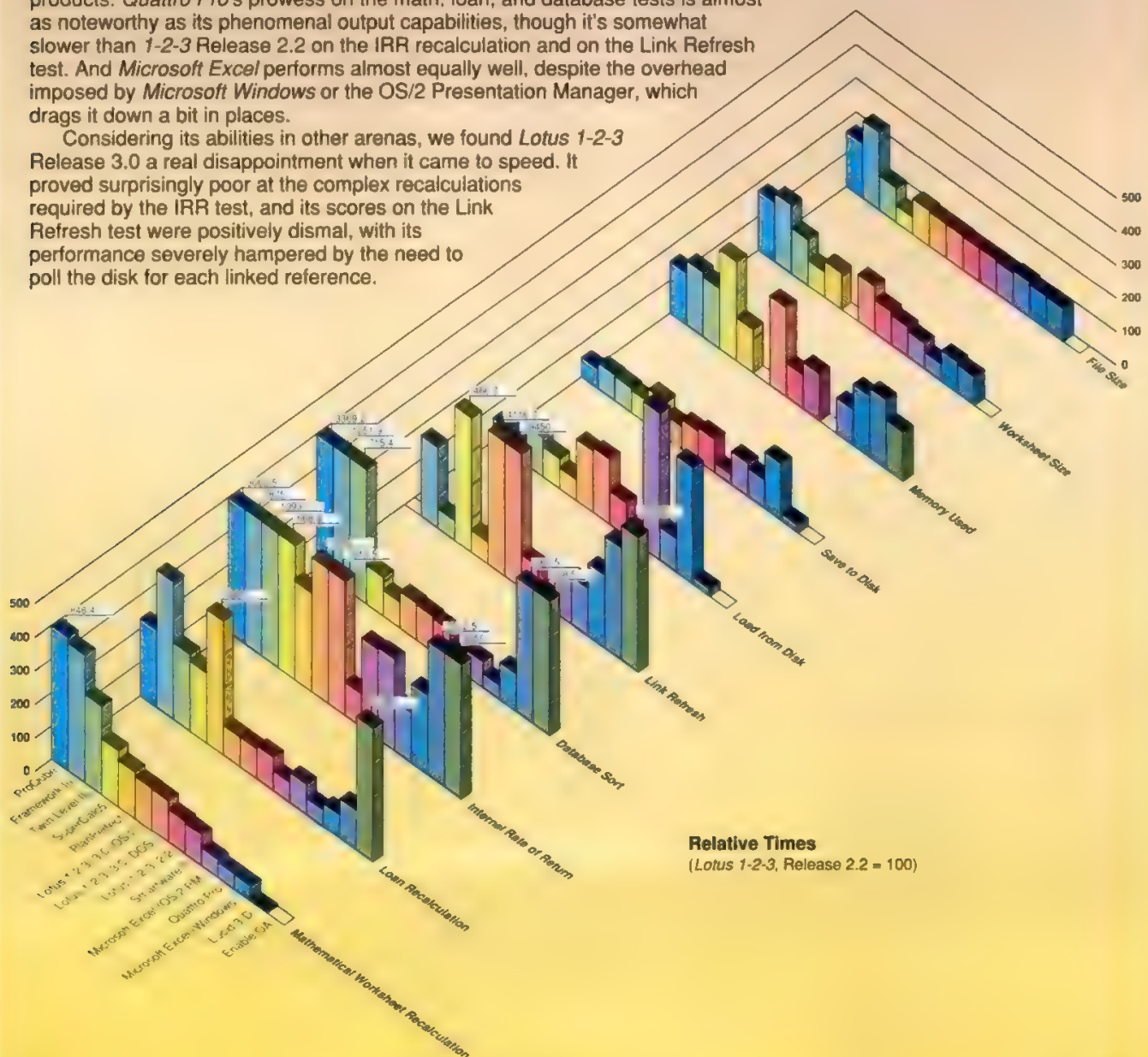


PERFORMANCE TESTS: COMPOSITE VIEW

The results of the spreadsheet performance tests indicate a wide range of abilities among the packages. Clearly, despite its aging design, *Lotus 1-2-3 Release 2.2* still stands up rather well against the competition in the performance arena, especially in the complex calculations of the Internal Rate of Return test. While *Lucid 3-D* is unsurpassed on straight mathematical calculations, its performance rapidly diminishes when it is called on to handle more-complex functions. *SmartWare II* is the sleeper of the bunch: on most tests it held its own against the standalone packages, and it did better than any others on the Link Refresh test.

But the prize for overall best performance goes to our Editor's Choice products. *Quattro Pro's* prowess on the math, loan, and database tests is almost as noteworthy as its phenomenal output capabilities, though it's somewhat slower than *1-2-3 Release 2.2* on the IRR recalculation and on the Link Refresh test. And *Microsoft Excel* performs almost equally well, despite the overhead imposed by *Microsoft Windows* or the *OS/2 Presentation Manager*, which drags it down a bit in places.

Considering its abilities in other arenas, we found *Lotus 1-2-3 Release 3.0* a real disappointment when it came to speed. It proved surprisingly poor at the complex recalculations required by the IRR test, and its scores on the Link Refresh test were positively dismal, with its performance severely hampered by the need to poll the disk for each linked reference.



ENDS



ProQube's WorkQube View lets you look at its three-dimensional workspace from any of six viewpoints and rotate from one to another easily.

records will wrap to subsequent pages, and you can sort data ranges using up to nine keys—a realistic number of choices.

ProQube's graphs aren't fancy, but they're easy to create, and you can print them right from the worksheet. You get nine types of data-driven graphs, with a shadowing option for area, bar, and exploding pie charts.

ProQube's macro language includes a learn mode and also sports useful special macro functions like @CHANGED, which reports if a worksheet has been changed, and @MEMORY, which returns the amount of RAM that is currently available. Macros are saved in separate files, making it simple to create and save libraries for common functions. In addition, *ProQube* has a reasonably extensive command language that can be used to create menus and help screens, control data input and reporting, set up conditional ac-

tions, branch to other parts of the program, and run DOS commands from within a *ProQube* application.

If you find the multiple-page worksheet approach appealing and its limitations don't stop you, *ProQube* may be the only spreadsheet you'll ever need. And if you already use *1-2-3*, *ProQube* is still useful as a utility for viewing, manipulating, and printing *1-2-3* data sheets in WorkQube View fashion. In a world of woolly mammoths, the small, sleek, and special can still survive.

Quattro Pro

by Catherine D. Miller

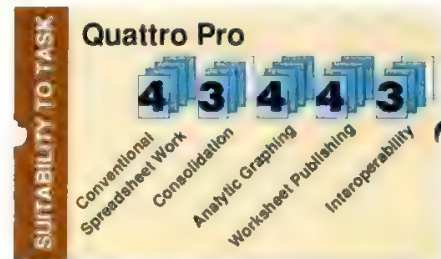
When Borland brought over the development team responsible for *Surpass*, the two units joined forces to create *Quattro Pro*. The \$495 software is a product of the modern programming era: it works equally well with a keyboard or a mouse; runs in either character or graphics mode, and supports 43-line EGA and 50-line VGA text displays. The result is a slick, capable spreadsheet that combines many of the best features of *1-2-3*, Releases 2.2 and 3.0 and of *Excel* without exacting hefty hardware requirements or forfeiting compatibility with earlier versions of *1-2-3*.

You can choose from among three user interfaces: *1-2-3*, Release 2.01—style menus, menus compatible with the original *Quattro*, and *Quattro Pro's* own attractive and well-designed versions. You can switch between modes and menu systems at any time. To help you organize your

work, the program contains excellent user-adaptable windows. You can open 64 files in windows at one time, and, as with *Excel*, the windows can be sized and moved, stacked, tiled, or overlapped. You can also split a single file in two, either horizontally or vertically.

Quattro Pro is strong at worksheet consolidation. Even though it doesn't offer the true 3-D capabilities of *SuperCalc5* or *1-2-3*, Release 3, its extensive file-linking abilities are well implemented. Wildcard file references let you link a worksheet to all open worksheets, giving you a pseudo-3-D ability to consolidate information from several sheets at once. You can save groups of worksheets in a single workspace for later use; this preserves your environment, including the position and size of all windows.

The program's function and command repertoire is large and includes several powerful tools for analyzing your data. For example, the What-If command lets you



see how changing one value affects the rest of the worksheet data. Powerful linear programming tools let you alter a combination of variables to achieve the best solution.

While standard database features are built into *Quattro Pro*, the program goes even further by working directly with external database files: *Paradox*, *Reflex*, and *dBASE II, III, III Plus*, and *IV* files can be queried without loading them into memory. *Quattro Pro's* macro support is likewise excellent; its macros are fully *1-2-3* compatible, and the program comes with a superb macro debugger—a boon if you often create complex macros to build your own applications or otherwise customize your spreadsheets.

ENHANCING YOUR DATA

As strong as it is in the basics, *Quattro Pro* really shines when it comes to output. Spreadsheet publishing features are available in abundance. Bitstream fonts, included with the package, can be created on the fly; no need to spend a session building them first. Fonts can be printed in either landscape or portrait mode, and you can



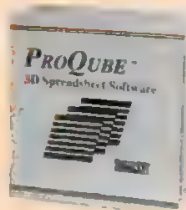
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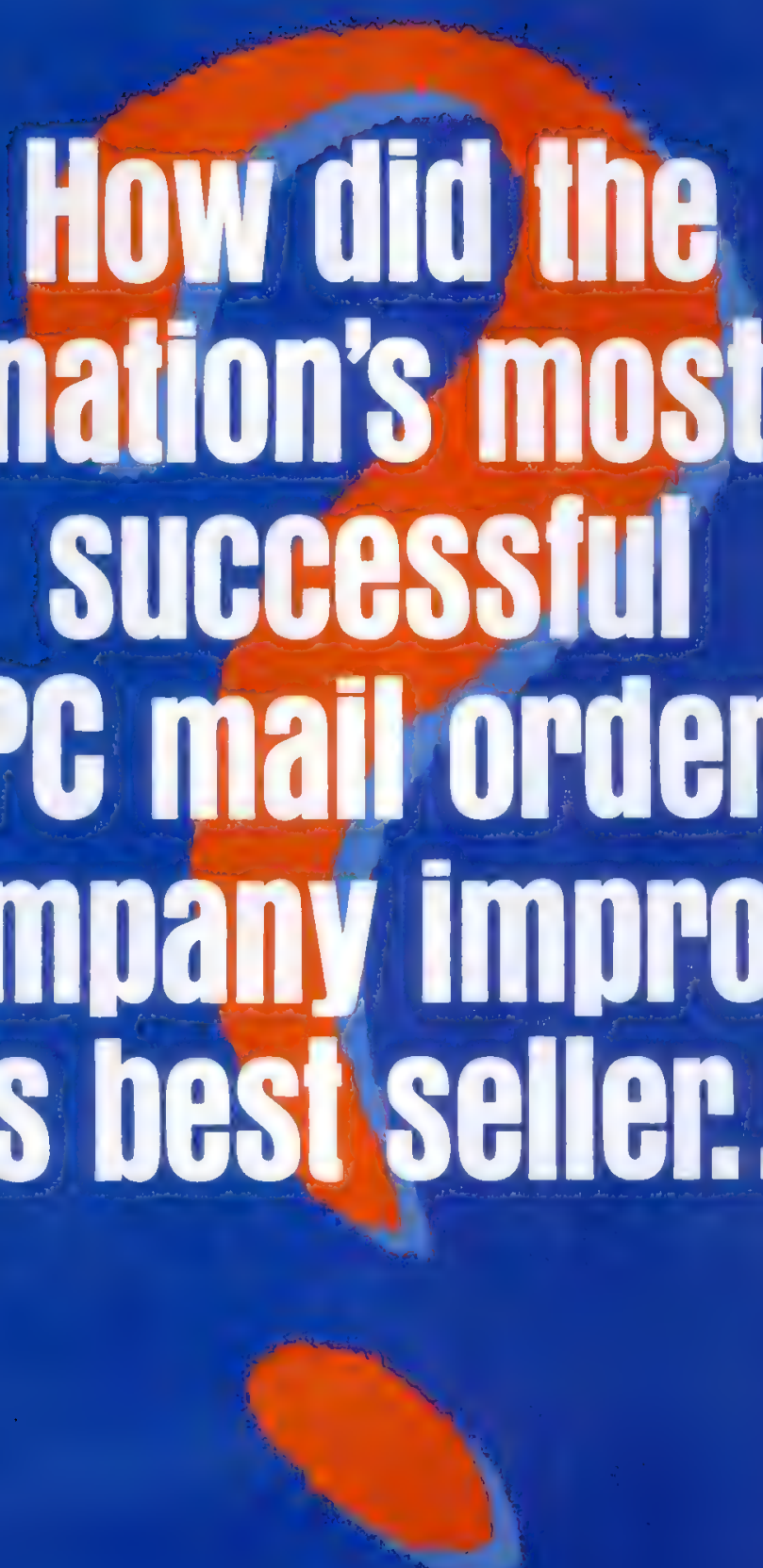
ProQube

FormalSoft, P.O. Box 1913, Sandy, UT 84091-1913; (801) 565-0971.
List Price: \$99.
Requires: 640K RAM, hard disk, DOS 2.0 or later.

In Short: *ProQube's* claim to fame is its true 3-D spreadsheet; in addition, its ability to rotate the workcube to visualize data from any of six viewpoints can be big help in some applications. But it's slow and its worksheet is limited in size, so it's good mainly for special purposes.

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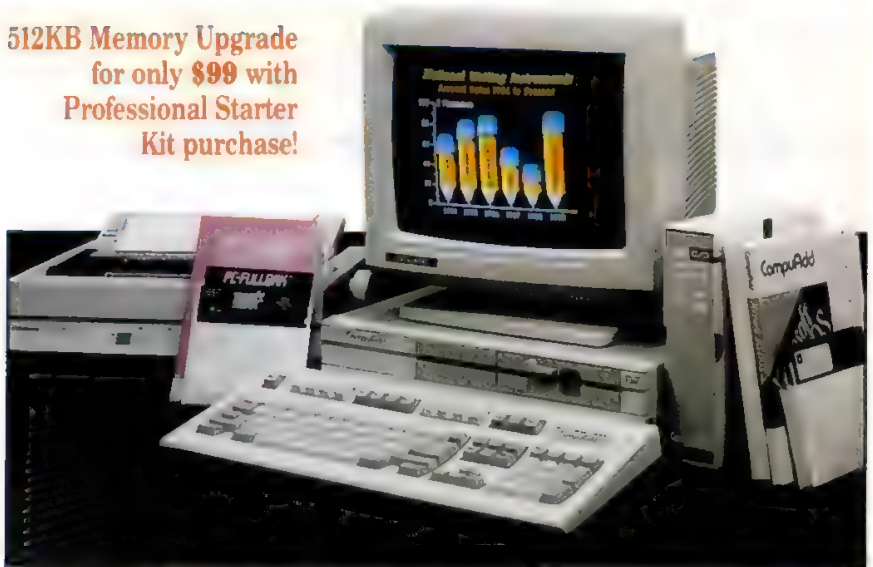
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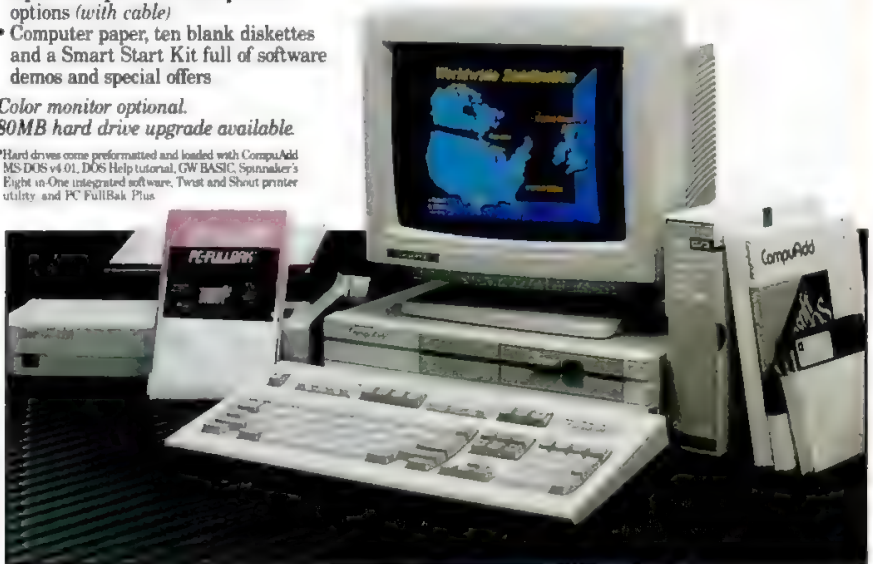
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Source: Byte Magazine

BYTE MAGAZINE SAYS...

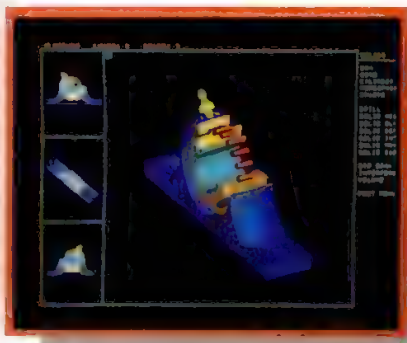
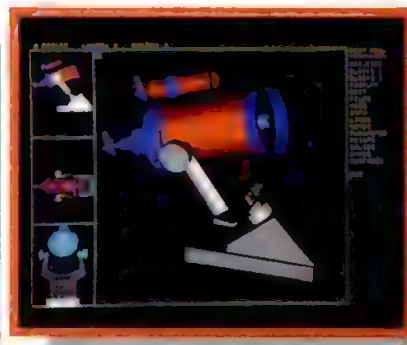
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COVER STORY SPREADSHEETS

dress up your reports with lines, gray or black shading, and bullets. For close-up inspections, the fine-print preview feature lets you zoom to any portion of the worksheet.

As for graphics, *Quattro Pro* offers hi-lo, pie, stacked bar, area, line, and a variety of other graph types. You can insert a graph of your data anywhere in the worksheet, and as you change your data, the graph changes to reflect the new information. Printing a spreadsheet with a graph is a simple one-step process.

Quattro Pro's drawing capabilities set it apart from the competition. Its Annotate function provides a full-featured drawing board, with a toolbox arrayed across the top of the screen. You can enhance your graph with text, pointers, and various shapes; determining element colors, line widths, object fill styles, and typefaces is up to you. You can use the clip art library included with the package to further embellish your graphs.

Most amazing of all, Borland manages to pack all this functionality into a spread-

sheet package that can run on any PC and that requires only 512K of RAM. We were able to perform all PC Labs benchmark tests, including our linking tests, without accessing expanded memory. For this, thank Borland's recently developed VROOMM (Virtual Real-time Object Oriented Memory Management) technology, which treats small 2K to 4K chunks of program code as objects to be swapped in and out of memory as the space is needed by worksheet data. This allows you to work with very large worksheets in a limited amount of memory.

Quattro Pro is not without its imperfections. When you preview a spreadsheet that will print in landscape mode, it appears sideways on your screen so that it's difficult to see how it really looks. You can't import third-party clip art, and both x- and y-axis graph labels are treated as one element and must be formatted the same way. Most seriously, its lack of extensive auditing features will make it an inappro-

FACT FILE EDITOR'S CHOICE

Quattro Pro

Borland International,
1800 Green Hills Rd.,
P.O. Box 660001,
Scotts Valley, CA
95066-0001; (408) 438-
8400.

List Price: \$495.

Requires: 512K RAM,
hard disk, DOS 2.0 or
later.

In Short: Borland packs a lot of power into this spreadsheet. An easy-to-use windowing interface, full 1-2-3 compatibility, strong worksheet consolidation features, the ability to view graphs and spreadsheet on the same screen, and direct access to external database files are only its most eye-catching features. Its comprehensive font support and well-rounded graphing and annotation capabilities produce beautiful output.



CIRCLE 424 ON READER SERVICE CARD

priate choice for those who require such capabilities.

An excellent set of manuals accompanies *Quattro Pro*, although this spreadsheet is so easy to use you may never need them. The compact Quick Reference Guide details *Quattro Pro*'s commands as well as their 1-2-3 equivalents. With its advanced memory-management techniques, its excellent graphics and spreadsheet publishing capabilities, and its robust file-linking and database features, *Quattro Pro* is at the forefront of the spreadsheet pack. Easy to use, this is one spreadsheet that's actually fun to work with.

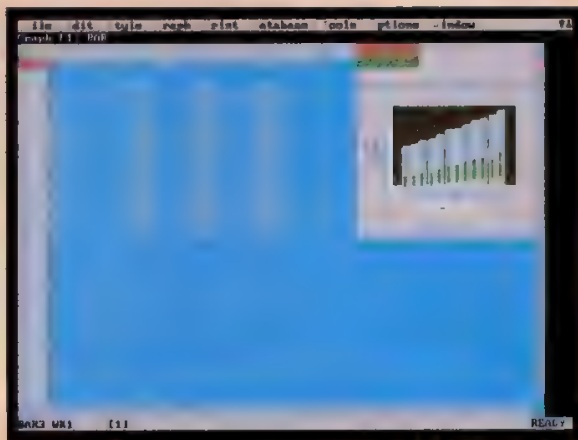
SmartWare II

by Henry Fersko-Weiss

Informix's *SmartWare II* has surprising power for a spreadsheet in an integrated program. In addition to an extensive number of functions, this \$695 package lets you open a host of windows at once, link spreadsheets, and even design applications with its built-in programming language. *SmartWare*'s spreadsheet is a speedy performer, coming in near the top on our file routine and recalculation tests.

SmartWare is not as tightly integrated as *Enable* or *Framework*. Its various applications are really independent modules that have been sewn together. You can even purchase the spreadsheet portion of the program by itself for \$349. Because of this approach, you can't display a word processing or database file in a window when you're in the spreadsheet module.

Quattro Pro lets you insert one or more graphs anywhere within a worksheet. A graph immediately reflects any changes that you make to the worksheet data on which it depends.



Quattro Pro is outstanding for customizing graphs. In addition to changing colors, typefaces, and point sizes, *Quattro Pro*'s graph annotator lets you add customized elements (shown in the toolbox at the top of the screen) to your graphs.



COVER STORY

SPREADSHEETS



FILE-LINKING SPREADSHEETS: SUMMARY OF FEATURES

Products listed in ascending price order

	Lucid 3-D \$99	ProQube \$99	Twin Level III \$199	Lotus 1-2-3, Release 2.2 \$495	Microsoft Excel \$495	PlanPerfect \$495	Quattro Pro \$495	SuperCalc5 \$495
GENERAL INFORMATION								
Minimum RAM required	256K	640K	380K	320K	640K	384K	512K	512K
Minimum disk space required	300K	1MB	1MB	320K	1.5MB	1.4MB	3.7MB	1.2MB
Hard disk required	☐	☒	☐	☐	☒	☐	☒	☒
Conventional memory available for data	400K	200K	174K	375K	180K	290K	Variable	200K
Expanded memory (LIM EMS version)	4.0	4.0	3.8	3.2	4.0	3.0	4.0	4.0
Extended memory	☐	☐	☒	☐	☒ (OS/2 only)	☐	☒	☐
Virtual memory	☐	☐	☒	☐	☒ (OS/2 only)	☒	☒	☐
LAN version available	☐	☐	☐	☒	☒	☒	☒	☒
OS/2 version available	☐	☐	☐	☐	☒	☐	☐	☐
Macintosh version available	☐	☐	☐	☐	☒	☐	☐	☐
HARDWARE								
Math coprocessor:								
8087	☒	☐	☒	☒	☐	☒	☒	☒
80287	☒	☐	☒	☒	☒	☐	☒	☒
80387	☒	☐	☐	☒	☒	☐	☒	☐
Works with mouse	☒	☒	☒	☐	☒	☐	☒	☐
Adapts to full-page monitors	☒	☐	☐	☐	☒	☒	☐	☒
Extended EGA/VGA text mode	☒	☒	☐	☒	☐	☐	☒	☒
Changes screen colors	☒	☒	☒	☐	☒	☒	☒	☒
USER INTERFACE								
Menus:								
Lotus-style	☒	☒	☐	☒	☐	☒	☒	☒
First-letter-sensitive	☒	☒	☒	☒	☒	☒	☒	☒
Pull-down	☒	☒	☒	☐	☒	☒	☒	☐
SAA-compliant	☐	☐	☐	☐	☒	☐	☐	☐
Custom	☒	☒	☒	☒	☒	☒	☒	☒
Maximum workspace:								
Open files	9	1	Unlimited	1	Unlimited	2	64	255
Pages per worksheet	1	512	1	1	1	1	1	255
Columns per page	254	512	256	256	256	256	256	255
Rows per page	9,999	512	8,024	8,192	16,384	8,192	8,192	9,999
Column widths (characters)	0-254	0-75	1-240	1-240	0-255	0-255	0-256	2-127
Split screens:								
Maximum number of screens	2	1	3	2	4	2	2	2
Formats multiple screens independently	☒	N/A	☒	☒	☒	☒	☒	☐
Scrolls multiple screens independently	☒	N/A	☒	☒	☒	☒	☒	☒
Hidden rows/columns/cells	☐ / ☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐ (cells with formulas)	☐ / ☐ / ☐	☐ / ☐ / ☐	☐ / ☐ / ☐
Multistep undo	☐	☐	☐	☒	☒	☐	☒	☒
Programmable hotkeys	☒	☒	☐	☐	☒	☒	☒	☒
Can extract partial spreadsheet	☐	☒	☒	☒	☒	☒	☒	☒
Cut-and-paste via clipboard	☒	☐	☐	☐	☒	☒	☒	☐
Automatic backup	☒	☐	☒	☐	☒	☒	☐	☐
FUNCTIONS AND OPERATIONS								
Logical and arithmetic operators	8	8	15	17	77	29	14	15
Functions:								
Math	17	26	21	17	22	26	19	18
Logical	5	6	11	9	6	14	8	19
Statistical	8	9	6	7	12	7	10	15
Financial	12	12	15	11	20	10	18	18
Date and time	9	13	16	11	13	14	12	18
String	5	17	21	19	14	17	21	20
Database	4	None	7	7	11	6	9	None
User-defined	☒	☐	☒	☐	☒	☒	☐	☐
Matrix manipulation	☐	☐	☒	☒	☒	☒	☒	☒
Regression analysis	☐	☐	☒	☒	☒	☒	☒	☒
What-if tables	☐	☒	☒	☒	☒	☒	☒	☒
Linear and nonlinear optimization	☐	☐	☐	☐	☐	☐	☒	☐

☐ —Editor's Choice ☒ —Yes ☐ —No

N/A—Not applicable; the product does not have this feature.

COVER STORY SPREADSHEETS

Lotus 1-2-3, Release 3.0 \$595
Enable/OA \$695
Framework III \$695
SmartWare II \$695

1,024K 640K 640K 640K
3MB 2.5MB 600K 3MB
400K Variable 270K 270K
4.0 4.0 4.0 4.0

■ (OS/2 only) ■
■ ■ ■ ■
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256 8 Unlimited 255 (with DOS)
256 32 1 1
256 1,024 32,000 999
8,192 9,999 32,000 9,999
1-240 0-72 0-255 0-80

2 3 1 2
■ ■ N/A ■
■ ■ N/A ■
■ / ■ / ■ / ■ / ■ / ■ /

■ ■ ■ ■
■ ■ ■ ■
■ ■ ■ ■
■ ■ ■ ■

17 15 11 18

17 22 20 23

8 15 13 12

10 12 7 9

12 11 6 16

13 25 14 26

18 22 16 22

11 None 5 12

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CONTINUES

You can, however, easily transfer data to and from these other applications.

SmartWare's interface does take a bit of getting used to. It follows a convention predating the market dominance of *Lotus 1-2-3* in which columns are identified by numbers instead of letters. Anyone bred to the *1-2-3* environment may find this approach awkward at first, but this system begins to look more sensible after a little time for adjustment: if you want to jump 15 columns, you needn't run through the alphabet. *SmartWare*'s menus are also off-standard. Although the two-line menus at the bottom of the screen follow the *Lotus* style, the terminology is different: for instance, you name a range by typing "/Sheet Name Define". And you must use the spacebar and backspace keys to scroll through the menus, instead of using the arrow keys.

A COLORFUL APPROACH

The worksheet screen seems stark at first; the black background is dressed up only by a simple, white border line. But you can make your screen look like a new-wave nightclub with a profusion of colors if you choose. Foreground and background colors can be added to the window border, window background, row and column labels, cursor bar, and different types of cells (formula, text, and so forth).

You can highlight individual cells and ranges by painting them. Such color coding can help you to find related worksheets in a program that allows you to open up to 50 windows simultaneously by splitting the screen horizontally and vertically over and over again.

SmartWare II lets you open up to 50 windows at once. Each window can be set to a different color, helping your eye to distinguish between different windows. This is especially useful when you're working with linked worksheets like these.



Windows are particularly helpful when it comes to linked spreadsheets, since they make it easier to follow the trail of data from one sheet to another. Unfortunately, you can update linked sheets only one at a time, making it a cumbersome operation to keep models with several linked sheets up to date.

SMART FUNCTIONALITY

Formatting choices for numbers, zero blanking, text justification, and printing characteristics are not exceptional; you get the standard currency, date, or percentage formats for numbers. But the program really shines when it comes to formulas: it has over 200 of them, compared with *1-2-3*, Release 2.2's 92. Engineers and other technical types will particularly appreciate *SmartWare*'s support for matrix mathematics.

According to Informix, about half the people who buy this program build applications with it. *SmartWare* includes an English-like programming language that lets you create menus, automate operations, and look to external programs (you can also record and edit macros). Informix has announced that the program will soon include links to minicomputer and mainframe programs; these links will let users design applications that can query central-

COVER STORY

SPREADSHEETS



FILE-LINKING SPREADSHEETS: SUMMARY OF FEATURES

Products listed in ascending price order

	Lucid 3-D	ProQube	Twin Level III	Lotus 1-2-3, Release 2.2	Microsoft Excel	PlanPerfect	Quattro Pro	SuperCalc5
FUNCTIONS AND OPERATIONS								
Recalculation:								
Automatic/manual	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Background	■	■	■	■	■	■	■	■
Intelligent	■	■	■	■	■	■	■	■
Natural	■	■	■	■	■	■	■	■
Row-wise	■	■	■	■	■	■	■	■
Column-wise	■	■	■	■	■	■	■	■
Iterative	■	■	■	■	■	■	■	■
FILE-LINKING FEATURES								
Can use link in function argument	■	■	■	■	■	■	■	■
Link returns a constant/a formula	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Can use wildcards to specify linked files	■	■	■	■	■	■	■	■
Links to nonexistent data	■	■	■	■	■	■	■	■
Updates links (on demand/automatically)	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Saves groups of worksheets in workspace	■	■	■	■	■	■	■	■
3-D FEATURES								
Multiple 2-D sheets in a single file	None	512	Unlimited	None	None	None	None	255
Defines ranges across pages	■	■	■	■	■	■	■	■
Groups sheets for common cursor movement	■	■	■	■	■	■	■	■
Formats sheets together	■	■	■	■	■	■	■	■
Rotates worksheet cube	■	■	■	■	■	■	■	■
DATABASE FEATURES								
Search-and-replace	■	■	■	■	■	■	■	■
Sorts by row/column	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Number of sort keys	2	9	256	2	3	10	5	3
Searches by arithmetic/logical criteria	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Joins two database tables	■	■	■	■	■	■	■	■
Multidimensional database (number of levels)	■	■	■	■	■	■	■ (64)	■
Queries external databases	■	■	■	■	■	■	■	■
Reads from and writes to external databases	■	■	■	■	■	■	■ (dBASE, Paradox, Reflex)	■
MACROS								
Macros in worksheet/library	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Auto-load/auto-close macros	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Event-driven macros	■	■	■	■	■	■	■	■
Macro libraries provided	■	■	■	■	■	■	■	■
Macros can execute DOS commands	■	■	■	■	■	■	■	■
Imports working Lotus macros	■	■	■	■	■	■	■	■
Macro recorder	■	■	■	■	■	■	■	■
Single-step trace mode	■	■	■	■	■	■	■	■
Macro debugger	■	■	■	■	■	■	■	■
AUDITING FEATURES								
Allows notes on formulas	■	■	■	■	■	■	■	■
Map mode	■	■	■	■	■	■	■	■
Shows formula dependencies	■	■	■	■	■	■	■	■
Shows circular references	■	■	■	■	■	■	■	■
GRAPHING FEATURES								
Graph types:								
Bar (2-D/3-D)	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Line	■	■	■	■	■	■	■	■
Pie	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■
Hi-to-open-close	■	■	■	■	■	■	■	■
Scattergram	■	■	■	■	■	■	■	■
Views graphs in color	■	■	■	■	■	■	■	■
Views graphs with worksheet	■	■	■	■	■	■	■	■
Annotates graphs with text	■	■	■	■	■	■	■	■

— Editor's Choice ■—Yes J—No

* With Allways installed

What is Peter Norton doing with a backup software package?

Why, what comes naturally, of course.

As you probably know, our classic, bestselling Norton Utilities® has saved the data of hundreds of thousands of grateful PC users around the world.

With the remarkable new Norton Backup™ we're out to save your data once again—before you have a chance to lose it.

What's more, we save it more quickly, more reliably and with much less effort on your part than any other program you can buy.

Which is all you really need to know to buy the Norton Backup right away.

But since there are a couple of other companies out there making similar claims, you might want to read on.

To see if we can back it up.

**Your data isn't
the only thing we save.**

Although regularly backing up your data is time well spent, you don't want to spend any more time than you absolutely have to shuffling floppies and listening to grinding disk drives.



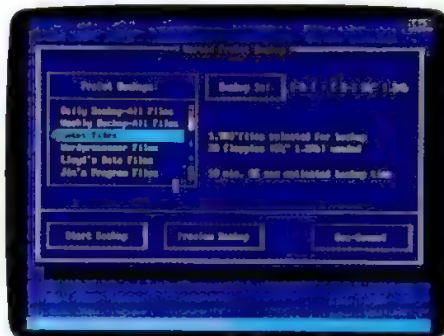
THE NORTON BACKUP

So you'll be glad to know that our unique Fastpath™ technology makes the Norton Backup as much as 200% quicker than the next quickest competitor.

Fastpath is actually a combination of technologies: Dual-DMA data transfer that reads your hard disk and writes to your floppy simultaneously, plus an advanced

disk control method that minimizes interruptions in the writing process.

Of course, you don't need to know any of that to appreciate the Norton Backup right away.



Selecting and deselecting files couldn't be more flexible—or intuitively obvious. Choose our unique Preset Mode and you can execute the entire process in three keystrokes. Whatever level of interaction you use, you'll backup in less time than ever before.

New tricks from the top dog.

In fact, you don't have to know anything at all.

What you don't know can help you.

The Norton Backup loads at a keystroke and automatically configures itself to your particular

keystrokes.

Whichever interface you choose, you'll know *before* you start precisely how much time and how many floppies you'll need.

You won't need many floppies, because the Norton Backup packs the most data onto the fewest disk

Namely the one between speed and safety.

Whether it's backing up, restoring or alerting you to file selection inconsistencies, the new Norton Backup is designed to be exceedingly reliable.

In fact, there's a patent



Backup and burn rubber. Our unique Fastpath™ technology makes us the fastest backup software on the market—up to 200% faster than the next fastest competitor.

system—no ponderous parameters to enter.

No complex syntaxes either. Because everything you need to know appears on your screen in highly organized pop-up windows.

Which means that saving—and restoring—everything from selected files to entire disks is as easy as point and shoot.

How often you point and shoot is up to you. Because the Norton Backup gives you a choice of three user interface levels.

(Not to mention five backup types, three levels of data verification, three levels of data compression and five display modes all the way up to 50 lines per screen.)

In fact, if you take advantage of our handy setup files, you—or someone on your staff who thinks backup is something you do with a gearshift—can execute the whole process in as little as three

ettes. It even does the formatting for you.

You won't need much time, either. Especially if you're on a network. Because, in addition to being faster than a speeding bullet, it backs up from and restores to multiple drives in a single bound.

pending on our Distributed Error Correction, a remarkable feature that actually does something that others have only claimed to do—restore backed up data from severely damaged disks.

Which is just the sort of data-saving ingenuity you'd expect from the people who brought you *UnErase*, the *Norton Disk Doctor*® and the rest of the Norton Utilities.

You'll find the Norton Backup, the Norton Utilities and the critically-acclaimed Norton Commander® at your favorite software dealer.

If you'd like to see us do our tricks for free, call us right away at **1-800-624-8999 Ext. 79A.**

We'll send you a Norton Backup demo disk.



Forget those cryptic command syntaxes and ponderous parameters. Our handy dialog boxes pop up to display all the information you need. All you do is point and shoot.

In Norton you trust.

Although we give you more choices than any other program, one of the nicest things about the Norton Backup is the choice you don't have to make.

Peter Norton
COMPUTING

CIRCLE 302 ON READER SERVICE CARD

COVER STORY

SPREADSHEETS

program is character-based, and several of its advanced features such as minimal recalculation and the undo feature can be removed from memory to allow more space for your spreadsheets. But we found it wasn't possible to run our linking tests unless we used expanded memory. *SuperCalc5* supports up to 32MB of expanded memory, so if you have the equipment for it, you can create large 3-D spreadsheets, loading as many as 255 into memory at one

SUITABILITY TO TASK

SuperCalc5



time. Files saved in *SuperCalc5*'s native .CAL format occupy less disk space than the same files saved in other formats because the program incorporates a squeezing technique to save disk space.

AUDITING POWER

SuperCalc5 has solid spreadsheet features that can perform just about any function; they give you great flexibility. Its most notable talent lies in its superb auditing capa-



FILE-LINKING SPREADSHEETS: SUMMARY OF FEATURES

Products listed in ascending price order

	Lucid 3-D	ProCube	Twin Level III	Lotus 1-2-3, Release 2.2	Microsoft Excel	PlanPerfect	Quattro Pro	SuperCalc5
GRAPHING FEATURES								
Customizes graphs with freehand drawing	☐	☐	☐	☐	☐	☐	☒	☐
Imports clip art (formats)	☐	☐	☐	☐	☐	☐	☒ (.CLP)	☐
PRINTING FEATURES								
WYSIWYG preview	☐	☐	☐	☒	☒	☒	☒	☒
Prints text and graphics together	☒	☐	☐	☒	☒	☐	☒	☐
Landscape printing	☒	☐ (graphics only)	☒	☒	☒	☒	☒	☒
Boxes and shading	☐	☐	☐	☒	☒	☐	☒	☒
Multiple fonts	☐	☐	☒	☒	☒	☒	☒	☒
PostScript support (text/graphics/combined)	☐ / ☐ / ☐	☐ / ☐ / ☐	☒ / ☒ / ☐	☒ / ☒ / ☒	☒ / ☒ / ☒	☒ / ☒ / ☒	☐ / ☐ / ☐	☒ / ☒ / ☐
Number of printers supported	185	60	15	84 (70*)	Any Windows or PM printer	450	163	150
Customizable print drivers	☐	☒	☐	☐	☐	☒	☐	☒
Plotter support	☐	☐	☒	☒	☒	☒	☒	☒
Background printing	☐	☐	☐	☐	☒	☒	☐	☐
Multiline headers and footers	☒	☐	☐	☐	☐	☐	☐	☒
Color printing	☒	☒ (graphics only)	☒	☒	☒	☒	☒	☒ (graphics only)
IMPORT/EXPORT								
Lotus 1.x (.WKS)	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒
Lotus 2.x (.WK1)	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒
Lotus 3.0 (.WK3)	☐ / ☐	☐ / ☐	☐ / ☐	☐ / ☐	☐ / ☐	☐ / ☐	☐ / ☐	☐ / ☐
Symphony	☒ / ☒	☐ / ☐	☐ / ☐	☒ / ☒	☒ / ☒	☐ / ☐	☒ / ☒	☐ / ☐
Multiplan (.SLK)	☐ / ☐	☐ / ☐	☐ / ☐	☒ / ☒	☒ / ☒	☐ / ☐	☐ / ☐	☐ / ☐
.DIF	☐ / ☐	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☐ / ☐	☒ / ☐
dBASE (.DBF)	☒ / ☒	☒ / ☒	☐ / ☐	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒
ASCII print files	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☐ / ☐	☐ / ☐	☒ / ☒	☒ / ☒
Delimited ASCII files	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☒	☐ / ☐	☒ / ☒	☒ / ☒
.CSV files	☐ / ☐	☒ / ☒	☒ / ☒	☐ / ☐	☐ / ☐	☒ / ☒	☒ / ☒	☒ / ☒
Lotus .PIC	☐ / ☐	☐ / ☐	☐ / ☐	☒ / ☒	☐ / ☐	☐ / ☐	☐ / ☐	☐ / ☐
Other	DacEasy	None	VisiCalc	None	None	User-definable	Quattro, Reflex, Surpass	XDIF
LOTUS 1-2-3 COMPATIBILITY								
Writes .WK1 files directly	☐	☒	☒	☒	☒	☐	☒	☒
Fully compatible with 1-2-3 macros	☐	☐	☐	☐	☒	☒	☐	☒
Has 1-2-3-compatible menu tree	☐	☒	☒	☒	☐	☒	☒	☒
DOCUMENTATION								
Quick Start booklet	☐	☐	☐	☒	☒	☒	☒	☒
Keyboard template	☒	☒	☒	☒	☒	☒	☒	☒
Reference card	☐	☐	☐	☒	☒	☒	☒	☒
Toll-free number for free support	☐	☐	☐	☒	☒	☒	☐	☐
Tutorial program available	☐	☒	☒	☐	☒	☒	☒	☒
Tutorial booklet available	☒	☐	☒	☒	☒	☒	☒	☒
Index	☒	☒	☒	☒	☒	☒	☒	☒
Command table	☐	☒	☐	☒	☒	☒	☒	☒
Context-sensitive help	☒	☒	☒	☒	☒	☒	☒	☒

☐ Editor's Choice ☒ Yes ☐ No

* With Always installed

COVER STORY
SPREADSHEETS

1990-1991

ENDS

HP-41C calculator screen showing the following data:

Label	A	B	C	D	E	F	G	H
1	Enter the number 7077070 in B2 and measure time to return to A							
2	7077070							
3	Square Root							
4								
5								
6								
7								
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CONSOLIDATION ACCESSORIES FOR 1-2-3

by Craig Stinson

For Lotus 1-2-3, Release 2 users, consolidation can be a problem. Lotus 1-2-3, Release 2.2 does only the most rudimentary form of file linking, and Release 2.01 does none at all. Moreover, neither version lets you work with more than one file at a time. But with a slick add-in called *Look&Link* from Personics Corp. of Maynard, Massachusetts, Release 2 users can get a taste of the advanced consolidation features offered by 1-2-3, Release 3, *Quattro Pro*, Microsoft *Excel*, and other new-generation spreadsheet programs.

Look&Link lets you display a worksheet in read-only mode along with your active worksheet. You can copy data from the second file to the active worksheet by pointing to the data you want to copy. Unlike plain old Release 2.2, which lets you grab only one exter-

nal cell at a time, *Look&Link* affords you the luxury of operating on ranges. You can even pluck data from external lookup tables. You can automate routine consolidations by creating "dependency trees"; at roll-up time, you simply name the tree and issue the Consolidate command.

Look&Link also lets you use custom @functions to create "live" links between the files. The drawback is that these aren't recognized anywhere outside of *Look&Link*. If you later move to 1-2-3, Release 3 or another program, you leave your linked models behind.

Two other third-party accessories are available to give a measure of consolidation power to Release 2.01 and *Symphony* users. @WSLINK (Goldata Computer Services, Ardmore, Pennsylvania) is an add-in that provides a single custom @function to bring Re-

lease 2.2-style file linking to Release 2.01.

And *XYZ Consolidate* (Intex Solutions, Needham, Massachusetts) is a separate program that operates on .WKS, .WK1, and .WR1 (*Symphony*) files. This program opens your files, prompts you through the consolidation process, and creates a separate output file with the consolidated information. It's smart enough to handle files that aren't structured alike, and it will let you do averages, weighted averages, and other arithmetic manipulations. But it takes some learning to use it properly, and it doesn't create "live" links between files.

Buying a consolidation accessory isn't the same as getting a new spreadsheet program. But if you like what you're using, it can be a big help at the end of the month. ■

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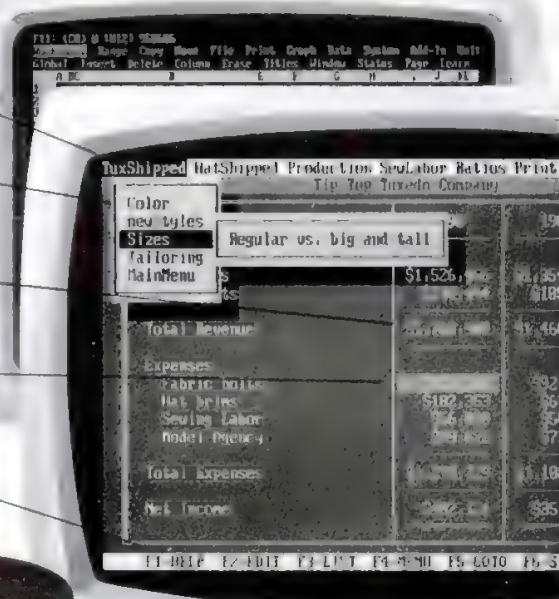
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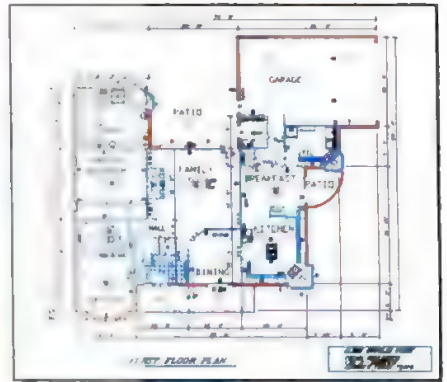
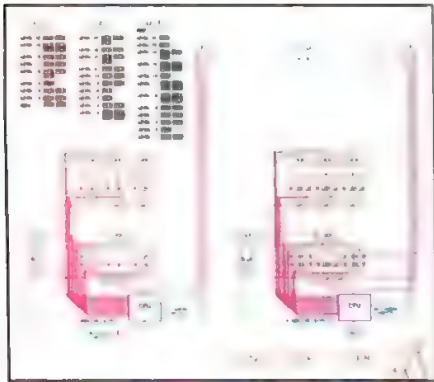
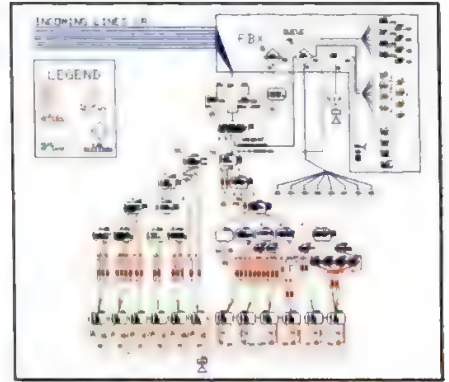
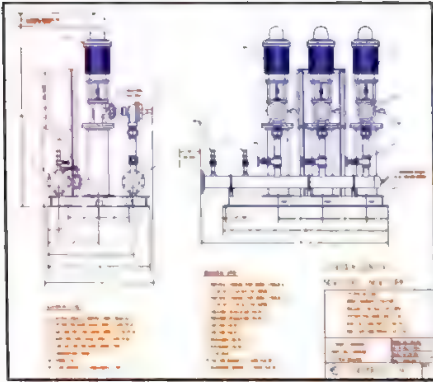


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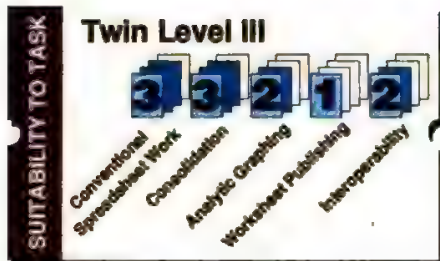
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Release 2.01 files, including data, functions, and macros; no conversion is necessary. You can use most 1-2-3 command sequences to run *Twin Level III* with nary a thought. The only 1-2-3, Release 2.01 command missing from *Twin Level III* is the /Data Parse command.

Twin Level III doesn't have multiple-page worksheets, so it's not three-dimensional in the usual sense. But it can hold multiple sheets in memory at the same time (the number is limited only by the amount of RAM in your computer). Up to three worksheets can be displayed simultaneously, and you can save and retrieve multiple worksheets as a group. Each worksheet is stored in a separate file, and an additional .WKP file remembers what files are in the group.

You can define global ranges between the spreadsheets in memory. But if you make a change in a named global range, the change is not reflected in other spreadsheets that refer to that range until the sheet is recalculated or reloaded. And using the same global range name in two or more worksheets can lead to confusion if both are in memory at the same time. For more-conventional file linking, you can use the External Range feature to link a spreadsheet in memory to a file on disk. In this case, changes are updated by loading the file containing the link into memory or by

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Mosaic Marketing Inc.,
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(617) 491-2434.
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compatibility plus good file linking and
consolidation support at a relatively low price,
Twin Level III looks attractive if you're on a
budget. But beware of its slow performance and
poor documentation.

CIRCLE 426 ON READER SERVICE CARD



EDITOR'S CHOICE

- Quattro Pro
- Microsoft Excel

Our Editor's Choice for spreadsheets comes down to a dead heat between *Quattro Pro*, the champion of the character-based world, and *Microsoft Excel*, the undisputed leader of the graphical interface world. Both offer superb analytical features, point-and-shoot file linking, near-presentation-quality graphics, solid connections with external database files, and output fit for the boardroom. Both stand out from the rest in performance, too, with *Quattro Pro* ranking first overall in our tests and *Excel* coming in a close second.

At the same time, the differences between the programs are significant. Though less striking today than it was when introduced in 1987, *Excel* is still a strong contender. It features arrays, user-defined functions and display formats, sophisticated naming capabilities, background printing, robust auditing services, a powerful macro language, and other features that its rivals can't match. On the other hand, *Quattro Pro*'s built-in Bitstream fonts give you far more options than you will typically get with *Excel*. It prints graphs and worksheets together on the same page and has a full range of drawing tools in its annotation functions. It supports direct access to both *Paradox* and *dBASE* files, has linear optimization and file compression utilities built in, and it offers an excellent macro debugger.

In the end, your choice will depend as much on strategic considerations as on a straight-up

comparison of features. *Quattro Pro* runs well in character mode on ordinary PCs, while *Excel* virtually demands a fast 286 or 386 PC with lots of memory. *Quattro Pro* is so compatible with 1-2-3 that Lotus emigres can go straight to work, but *Excel*'s ability to exchange data transparently with other Windows programs and its file compatibility across three operating platforms (Macintosh, Windows, and PM) are equally strong considerations for many.

Which brings up the question, why not 1-2-3? 1-2-3, Release 3.0's three-dimensional design is superbly adapted for consolidation problems, and its industrial-strength database features make it a good choice for power users looking ahead to SQL. But its additional features strain its menu system, and its unorthodox use of extended memory makes it an uneasy partner for traditional DOS applications that depend on expanded memory. It lags behind the competition in performance and output quality as well. Though Lotus 1-2-3, Release 3.0 is more than a small step up from Release 2.2, the giant leap from Lotus won't come until Lotus 1-2-3/G is released later this year.

An honorable mention is due to *Lucid 3-D*, a great value at only \$99. It's fast, easy to use, exchanges data with other DOS programs through its built-in clipboard, and has rich macro features. If the spreadsheet application is secondary for you and you need only the basics, *Lucid 3-D* may be your most cost-effective choice.

using the "/Range Name External Update" command.

INFORMATION SHARING

Twin Level III's data sorting and query functions are quite similar to 1-2-3's, but it goes 1-2-3 one better by letting you have up to 256 sorting keys instead of 2. The program's Easyform feature lets you define an area outlined by a box for data entry, editing, and criterion specification, a

nice touch if you prepare spreadsheets for people who may be confused by 1-2-3's criterion range concept.

You can print graphs directly from the spreadsheet program. But printing graphs at higher resolutions requires an add-on utility called EMUPLOT. Graphs include line, xy, vertical, horizontal, and 3-D bar charts, 2-D and 3-D pie charts. A graph input form lets you enter data, label content, and formatting instructions easily.

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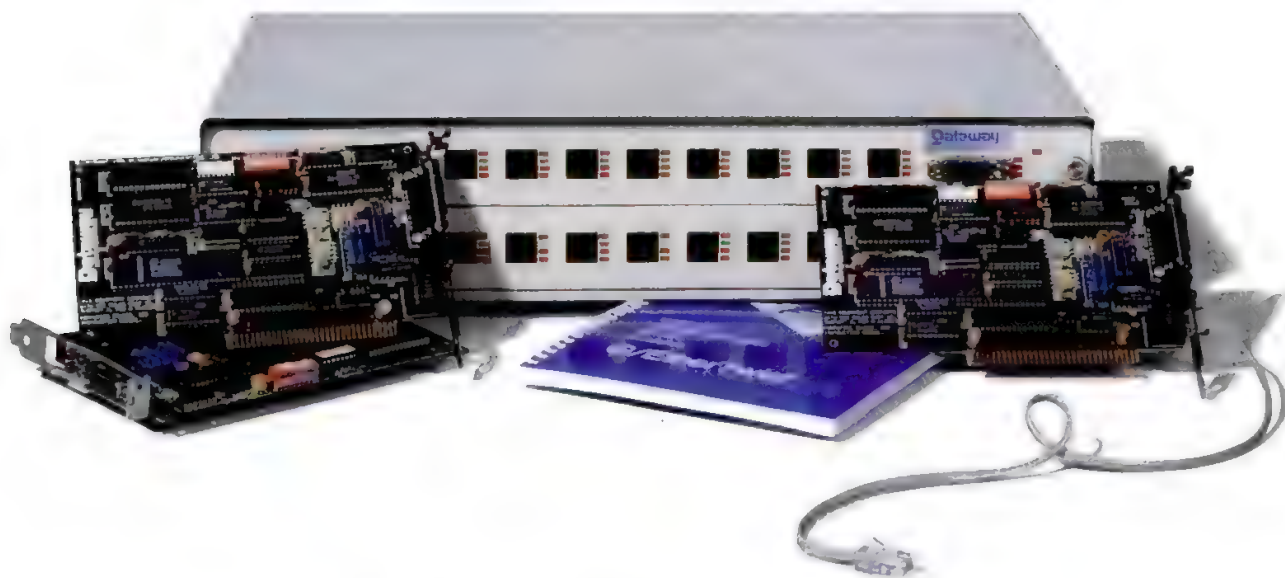
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CIRCLE 146 ON READER SERVICE CARD

FOR PEACE OF MIND, AUDIT YOUR SPREADSHEET

by Henry Fersko-Weiss

One out of every three spreadsheets you create is likely to have errors lurking in it. At least, that's what the experts we spoke with say. Even the most careful spreadsheet builder can make a circular reference or leave a row of cells out of a total, or reference a label instead of a value in a formula. And while some errors are obvious (they can be caught just by looking over the worksheet for cells that read 0 or ERR) too many others are easy to miss. Their invisible distortions can cause disaster when the spreadsheet is used for making critical decisions.

Luckily, there is a way to catch many of these subtle errors. Auditing your spreadsheet is similar to using a spelling and grammar checker on a word-processed document. Auditing tools automatically trace formulas from cell to cell—across hundreds of rows and columns—and help you review complex nested macros. In the process, you might discover bad formula syntax, find typos in cell addresses, and uncover poor design elements.

Auditing tools can also help you out when you need to unravel someone else's worksheet. By locating and tracing all formulas, macro commands, and data paths, you get a very clear idea of how information gets from one place to another in the worksheet.

In tribute to its importance, some

spreadsheet programs now incorporate auditing in their list of functions. The leader in this respect is undoubtedly Computer Associates' *SuperCalc5*, which has a very full and powerful set of auditing tools. *Excel* also has strong auditing functions, and other spreadsheets.

For heavy-duty jobs, two standalone auditors, *The Cambridge Spreadsheet Analyst* from Symantec Corp. (\$149.95) and *The Spreadsheet Auditor* from Computer Associates International (\$99), can help you to go beyond the three or four simple functions that most spreadsheet programs offer. These standalone programs will run between 25 and 30 different tests on your worksheets. Both work with .WK1 files, so you can use them with any spreadsheet that can write to this format, though macros that don't translate can't be checked. *Auditor* also works with files from earlier versions of *SuperCalc*.

POLICING YOUR DATA

Mapping is one of the most basic auditing functions. A map shows you a condensed view of your spreadsheet, allowing you to view anywhere from 38 to 73 columns at once. Each cell's contents is represented by a symbol, such as F for formula, L for label, N for number, and M for macro. In *Analyst's* version of a map view, there are nine

different symbols. A couple of these are used to indicate cells that contain copies of a formula from a neighboring cell.

The map view gives you an overview of what's happening in your worksheet. For example, if an N is sitting in the middle of a row otherwise occupied by a string of formulas, it's a good guess that a number has been incorrectly written over a formula.

While you're in the map view mode, you can trace the flow of formulas to see if they look right. In *Auditor*, you simply move the cursor to a formula cell and press F8; all the cells referenced by that formula are then highlighted. You can quickly move through them to make sure that the formula is accurate, and that all the cells that should go into a calculated result are accounted for. This procedure is good for uncovering mistakes that may have occurred if rows and columns were inserted after a formula was written. Another approach highlights all the formulas that use a particular cell.

Some auditing techniques are based on listing formulas that have questionable references. Auditing packages will typically let you look for formulas that reference labels, blank cells, null cells, cells that are outside the range of your worksheet, and ranges that have reverse addresses (starting with the lower-right

CONTINUES



Twin Level III's data-entry feature, called Easyform, makes data entry, editing, and querying easier than if you had to do it directly in the spreadsheet.

Other helpful features include an auto-learn macro mode, user-defined functions, automatic column-width settings, one-line file descriptors for documenting files, the ability to string search and replace within a range, and flexible interpretation of entries in date- and time-formatted ranges.

But *Twin Level III* does have some limitations. It's slower than *1-2-3*, partly because it uses background recalculation that can't be turned off. The documentation is only so-so: it consists of three separate booklets, with information about various releases of the program scattered throughout. The program supports no built-in fonts and has no WYSIWYG page-preview function, which will be missed by Lotus users who have *Always*.

All in all, though, *Twin* is a good

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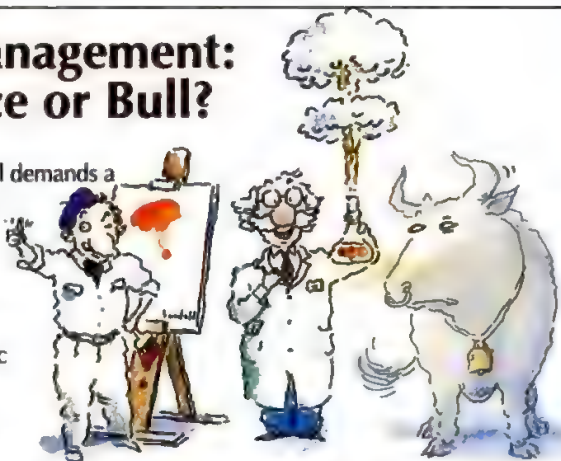
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COVER STORY
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coordinate).

Auditing packages can also be useful for maintaining your spreadsheets. *Analyst* comes with a companion program called *Comparator*, which lets you compare two spreadsheets for differences in their underlying structures. By comparing the working copy of your spreadsheet with a backup copy, *Comparator* helps you make sure that the model hasn't been contaminated with errors during routine use.

IT TAKES WORK

While software can help automate some of the more tedious auditing tasks, auditing is still a very interactive process. It requires work on your part to go through all the formulas that may have errors. With a standalone program, you'll have to go back to the original worksheet to correct the errors.

You should know that no auditing program can find all your errors. If you make false assumptions in your model or if you enter values that are only slightly off, no program can help you. Consequently, you should sit down and conscientiously think through your model at the outset, using the auditing package only to check your carefully planned work. This won't be very much fun, but protecting yourself from fatal spreadsheet errors is worth the pain. ■

spreadsheet program with several welcome features that extend its utility. Lower-priced than 1-2-3 and highly compatible with it, it can be a good choice if you must be compatible with the 1-2-3 world. ■

Bruce Brown is a Connecticut-based consultant and writer and a frequent contributor to PC Magazine. **Henry Fersko-Weiss**, also a frequent contributor to PC Magazine, is a free-lance writer based in Warwick, New York. **Catherine D. Miller** is a former staff writer at PC Magazine. **Bill O'Brien** and **Robin Raskin** are contributing editors of PC Magazine. **Craig Stinson** is a contributing editor of PC Magazine and editor of PC Magazine's *Spreadsheets* column. **M. David Stone** is a contributing editor of PC Magazine.

Perhaps The Best Way To Choose A Spreadsheet Is By The Numbers.

PC WEEK/REVIEWS SCOREBOARD

Attributes	Excel 1.01	CA SuperCalc5	Lotus 1-2-3 2.2	Lotus 1-2-3 3.0	Microsoft Excel 2.0	PS VP-Planner Plus 2.0
Date Integrity (1.00)	8	10	8	9	10	8
Ease of manipulating spreadsheet data (1.00)	7	9	8	10	8	8
Quality of documentation (1.00)	8	10	9	9	10	8
Performance relative to price (0.93)	10	7	7	6	7	9
Minimized RAM requirements (0.92)	9	10	10	5	6	10
Weighted Score	8.3	9.2	8.4	7.9	8.3	8.5

in order of importance

In a spreadsheet world filled with personal opinions, misleading claims, and advertising hype, you may want to consider what an objective third party has to say.

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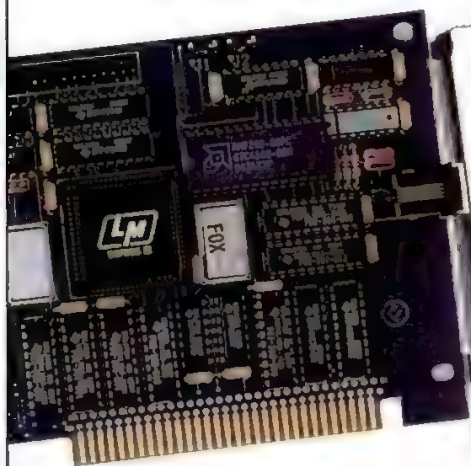


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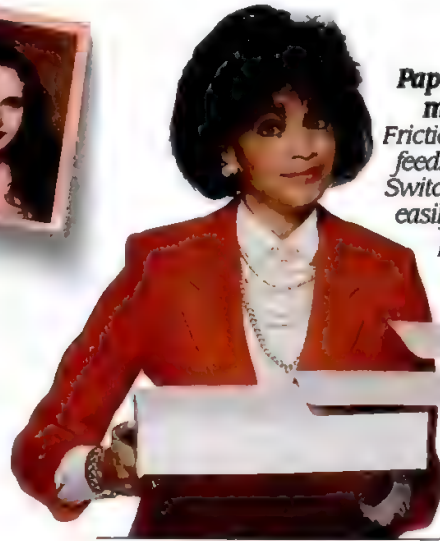
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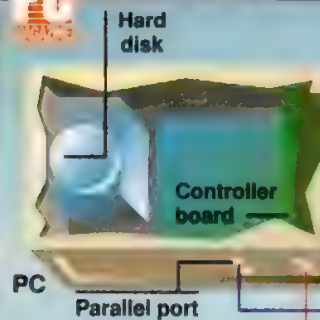
If you need output at a higher resolution than the HP LaserJet II's 300 by 300 dots per inch, you could buy a Varityper VT600W. Or you could buy one of these high-resolution printer controllers and save over \$15,000.

by Edward Mendelson

With printers as with computers, what seemed amazing five years ago looks primitive today. Back in 1984, the 300-dot-per-inch resolution of the original Hewlett-Packard LaserJet was as impressive as the 6-MHz 80286 in IBM's shiny new AT. Today, as 80486 machines begin to arrive, desktop laser printers are making a slower but equally impressive advance toward resolutions of 600 dots per inch and more.

ADD-IN LASER BOARDS HI-RES CONTROLLERS

A TWO-PART INVENTION



1

These high-resolution controllers each consist of a controller board that fits into a slot in your PC and an interface board that plugs into the I/O slot at the rear of your Hewlett-Packard LaserJet Series II or some other supported printer.

2

The controller board does the work of processing the high-resolution page image. Scalable fonts, as well as any supporting software (including drivers or the page description language), are stored on the PC's hard disk and may be downloaded to the controller board at start-up.

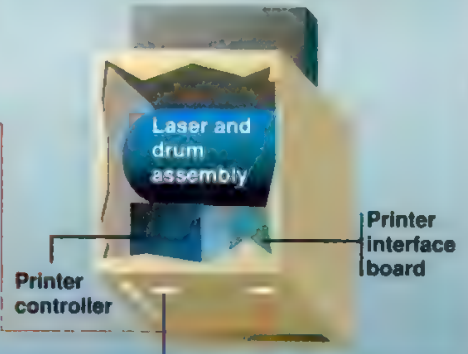
3

The page image is sent over a custom cable supplied by the vendor, bypassing the printer's built-in controller. The controller board modulates the laser diode's beam directly, allowing the resolution to be boosted above the normal 300 by 300 dots per inch supported by the LaserJet II.

4

The standard parallel cable remains in place. The high-resolution controller uses it to send form feeds to the printer; it can also be used to send standard print jobs to the LaserJet.

Hewlett-Packard LaserJet Series II or compatible



But you don't have to junk your LaserJet to get high-resolution printing on a desktop. Instead, you can plug an advanced printer controller board into your PC, attach it via a supplied cable to the alternate I/O port on the back of the LaserJet (or most other printers based on the Canon SX engine). You'll get at least twice the print quality of the LaserJet alone; and, in most cases, you'll also get scalable fonts and faster printing.

The four add-on controllers tested for this review print output that ranges from 600 by 300 to 800 by 800 dots per inch. Three of the boards also add PostScript capability to the LaserJet, while the fourth, the LaserMaster board, offers comparable capabilities through a different, proprietary means. Each board gives you at least the 35 standard PostScript fonts and lets you add more. All but one of the controllers let you continue to use the LaserJet exactly as you did before with applications that don't support the add-in board.

Installing one of these controller cards is analogous to putting a turbo board into your computer. Just as it once made sense to put an 80386 board into an 80286 machine, it still makes sense to use an add-on controller to upgrade a LaserJet to 600 dpi. In fact, it's the only way to get a desktop 600-dpi printer. The \$16,995 Varityper VT600W is too slow and too bulky for any desk, and the 1,000-dpi \$7,495 LaserMas-

ter 1000 Plain-Paper Typesetter, although the same size as a LaserJet, uses a LaserMaster controller card in the computer.

BRAIN TRANSPLANT

The four boards reviewed here, the DP-Tek LaserPort PS 600, the EiconScript H8300/PC, the LaserMaster Series III Professional, and the RIPS Image 4000i, all work in broadly similar ways. Three of the four come with 3- to 6MB of RAM, which they use for building a high-resolution image of the page. The DP-Tek board uses 5.5MB of your computer's RAM for the same purpose. All four take over from the LaserJet's built-in controller the job of controlling the laser beam that "paints" the image of a page onto the printer's drum. The EiconScript and RIPS boards double the horizontal resolution of the printer through electronic means but don't increase the vertical resolution, which is normally limited by the precision of the drum. However, the DP-Tek and LaserMaster boards manage to increase the vertical resolution as well by using the laser beam to change the size and shape of individual pixels.

Enhanced resolution can bring a startling increase in print quality. At 300 dpi, even the best bitmapped soft fonts have jagged edges; moreover, slanted lines and curves in graphics are far from smooth. At 600 by 300—twice the resolution of a La-

serJet—the edges are twice as smooth, and each further enhancement brings comparable advances. But even the 800 by 800 dpi of the LaserMaster Series III is less than half the 1,250 dpi used by low-level typesetters, and far below the 2,540 dpi of the page you're reading now. If you use your printer only to create proofs for pages to be printed by a service bureau, an add-on controller isn't worth the money. But if you want high-quality printing on your desktop, nothing else brings you so much improvement at so reasonable a cost.

REVIEW CRITERIA

For this review, we included boards that increase the resolution of the HP LaserJet II beyond its standard 300 by 300 dpi. (For PostScript add-in boards with 300-dpi resolution, see "Post-Purchase PostScript," *PC Magazine*, April 11, 1989.) All these boards also work with many other Canon-engine printers; consult the board vendor to learn if your printer is supported. One printer that won't work is the Hewlett-Packard LaserJet IIP, which lacks the alternate I/O port found on the back of its bigger siblings. All the boards can be used as printer servers on networks.

Our tests concentrated on type quality, partly because none of these boards improve gray-scale images beyond a barely acceptable level. (If you need a board that you can specifically design for gray-scale improvements, see "How to Get the Most Out of Your Laser Printer," *PC*

ADD-IN LASER BOARDS HI-RES CONTROLLERS

Magazine, November 14, 1989.)

All these boards come with either a PostScript interpreter, or, in the case of the LaserMaster, a graphic interface that produces similar results. The boards that come with a PostScript interpreter work with any application that has a PostScript driver, while the LaserMaster requires special support. Although LaserMaster is not a PostScript board, it can use Adobe's encrypted Type 1 fonts; the RIPS board can also read Adobe fonts. The other boards are limited to their own clone-PostScript fonts or to Bitstream and other third-party PostScript fonts.

DP-TEK

LaserPort PS 600

by Edward Mendelson

Most of the boards in this review cost \$3,000 or more, come in a full-length size bristling with RAM chips and a graphics coprocessor, and include a thick manual. By contrast, DP-Tek's zen-like LaserPort PS 600 (\$899) fits on a sparsely populated half-length board and has a slim six-page installation guide.

Unlike its rivals, the DP-Tek LaserPort board doesn't do the work of building the image of the page that it sends to the LaserJet to print. Instead, it relies on a software PostScript interpreter that uses the CPU and RAM in your computer to generate fonts and build pages. The board does only one job: it makes the LaserJet print at a razor-sharp 600 dots per inch—and it does that brilliantly.

Other high-resolution boards come with dedicated PostScript interpreter software, but the LaserPort PS 600 can use any PostScript interpreter that has a driver for it. DP-Tek ships the board with a copy of QMS's *UltraScript PC Plus*, which lets you print either from within an application or print files that an application has printed to disk.

Either way, *UltraScript* needs at least 5.5MB of free RAM to build a 600-dpi page, and QMS suggests 7MB for better speed. *UltraScript* also uses 70K of DOS RAM for two TSRs that let you print from within applications. Because of this, the DP-Tek combination may be impractical if you have other uses for your RAM; its competitors use dedicated RAM on the board itself and leave your system RAM alone.

INSTALLATION HEADACHES

You could probably install the LaserPort board with your eyes closed. Plug the controller board into the PC and the interface board into the LaserJet, attach the cable, let the installation program run automatically; and you're done.

The *UltraScript* software can be trickier, however. If you're using your machine for nothing but *UltraScript*, installation is straightforward. But it became a nightmare on my 386 machine equipped with the *QEMM-386* memory manager. The installation program wasn't smart enough to see that much of my expanded memory was in use by other software; it told me that I could use most of it for *UltraScript*. But when I did, the system immediately crashed, and QMS couldn't figure out why until I explained the problem. The moral of

the story is, until the promised new installation software that better handles extended memory arrives, expect trouble.

Fortunately, the elegant and exact printed output is worth the effort. In PC Labs tests with a 6MB machine, the DP-Tek LaserPort proved the fastest of the PostScript boards when printing the graphics file, although it was much slower than the LaserMaster with its proprietary (non-PostScript) high-speed controller. However, it printed the 20-page *WordPerfect* text file at less than half the speed of any of the other boards we reviewed. Worse, the keyboard is unusable for an annoying amount of time, while the *UltraScript* software laboriously builds each page and sends it out to the printer.

UltraScript comes with 47 hinted URW fonts—the standard PostScript fonts plus three varieties of Lucida. It doesn't import Adobe fonts, but about 20 extra font fam-

HIGH-RESOLUTION PRINTER BOARDS: SUMMARY OF FEATURES

Products listed in ascending price order

	DP-Tek LaserPort PS 600	Eicon Technology Corp. EiconScript H8300/PC	LaserMaster Corp. LaserMaster Series III Professional	RIPS RIPS Image 4000i
List price (tested board)	\$1,195	\$1,695	\$2,995	\$3,000
Board type	16-bit	8-bit	8-bit	8-bit
Board size	Half-length	Full-length	Full-length	Full-length
Resolutions (dpi)*	300 x 300, 600 x 300, 600 x 600	300 x 300, 600 x 300	400 x 400, 600 x 600, 800 x 800	600 x 300, 300 x 300 (separate version)
Coprocessor	None	Motorola 68000	Texas Instruments TMS 34010	Intel i960
Number of fonts	47	35	135	35
Source of fonts	URW	Bitstream	ITC, URW, others	Bitstream
Accepts Adobe Type 1 fonts	☐	☐	☒	☒
Graphics language	PostScript clone	PostScript clone	DDPI (proprietary GDI)	PostScript clone
RAM required in PC	5.5MB	7K	27K (none when run with Windows or Ventura)	None
Maximum RAM on printer board	N/A	4MB	6MB	6MB
Applications supported	PostScript	PostScript	AutoCAD, GEM, Microsoft Windows, Microsoft Word, OS/2 Presentation Manager, PageMaker, Ventura Publisher, WordPerfect, others	PostScript

— Editor's Choice ■—Yes □—No

N/A—Not applicable: the product does not have this feature.

*For the HP LaserJet Series II. Additional resolutions may be available for other printers.



FACT FILE

LaserPort PS 600

DP-Tek, 3031 W. Pawnee, Wichita, KS 67213; (800) 727-3130, (316) 945-8600.

Price: \$899; with QMS's *UltraScript PC Plus*, \$1,195.

Requires: 5.5MB RAM, hard disk with 4MB free, DOS 3.1 or later, IBM AT, 386, or compatibles; one 16-bit half-length expansion slot; laser printer based on the Canon SX engine (including the HP LaserJet Series II); I/O slot in printer; QMS's *UltraScript PC Plus*.

In Short: Relying on third-party PostScript software to build the image of a page, the LaserPort PS 600 produces beautiful output at 600 by 600 dots per inch, but potential installation headaches and its huge appetite for system RAM make it less attractive overall than its competitors.

CIRCLE 408 ON READER SERVICE CARD

ilies are available from QMS. More drivers for the LaserPort board are being written by the vendors of another software PostScript interpreter, *Freedom of Press*. However, that program does not allow printing from within an application. Other drivers may appear in the future.

The LaserPort PS 600 produces superb output at a reasonable price, but you'll need plenty of unused RAM in your computer to get it.

EICON TECHNOLOGY CORP.

EiconScript H8300/PC

by Robin Raskin

Eicon Technology Corp. is a Canadian company that specializes in communications products and has more recently entered the laser printer market. The EiconScript H8300/PC board uses Eicon's proprietary PostScript interpreter to produce lovely output at 600 by 300 dpi. Nonetheless, you should stay away from Eicon's printer boards until some awkward design features are remedied.

Eicon Technology believes that many people want to use the EiconScript board as a full-time printer engine—and not necessarily with the Hewlett-Packard LaserJet. So, in addition to *EiconScript*, the company's clone PostScript interpreter, the board comes with a proprietary PCL interpreter called *EiconJet*. Though you can send PCL files to your LaserJet via the Eicon board (the software includes batch programs to switch between *EiconJet* and *EiconScript*), you can't send jobs directly to the LaserJet through your parallel port

ADD-IN LASER BOARDS HI-RES CONTROLLERS

unless you use a special command-line argument in the program's LPADOS utility. The Eicon board doesn't just enhance your LaserJet—it consumes it.

Eicon's hardware components are similar to those of other boards we reviewed. The interface card is a full-length, 8-bit board with a Motorola 68000 processor (Eicon also makes a Micro Channel version). It comes with 2MB of memory standard, and you must add at least one piggyback 1MB module to print at the higher 600 by 300 resolution (you can expand it up to 4MB total). It lagged behind the RIPS PostScript board in our performance test results, but Eicon is working on a new version of the board that will be equipped with the same speedy Intel i960 RISC processor as the RIPS board, which should improve its speed.

An adapter board fits into the optional I/O slot at the rear of the HP LaserJet Series II, and a proprietary cable, which carries the high-resolution bitmap image, connects the two boards. The Eicon board appears as LPT2 or LPT3 to your software, but the LPT1 connection is also required to send the form feed to the printer. Both the DP-Tek and LaserMaster boards also handle form feeds on LPT1, but, un-



FACT FILE

EiconScript H8300/PC

Eicon Technology Corp., 2196 - 32nd Ave. (Lachine), Montreal, Quebec, Canada H8T3H7; (514) 631-2592.

Price: EiconScript H8300/PC (300 by 300 dpi), \$1,495; H8300/MCA (300 by 300 dpi), \$1,895; additional memory, \$300 per MB.

Requires: 7K RAM for memory-resident program, 2.5MB hard disk space for fonts, DOS 3.0 to 4.0, IBM XT, AT or PS/2 model 30 or compatible, full-sized slot, one parallel port, I/O slot in printer; HP LaserJet Series II; most Canon laser printers and Canon SX engines supported. (Canon models LBP-8II [R/T], LBP-8III and LBP-8III [R/T] require a Canon video interface card, obtainable from Canon.)

In Short: The EiconScript H8300/PC does nice things with PostScript output at 600 by 300 dpi, but suffers from lackluster performance and overcomplicated software. Those who want to use their LaserJets in native mode will have problems with this one.

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like with the Eicon board, you are free to access the native LaserJet when their printer boards are not being used.

PITFALLS FOR THE UNWARY

The Eicon software and documentation are unnecessarily complicated. The software comes on ten 5.25-inch disks, while the documentation consists of three separate



PERFORMANCE TESTS: HIGH-RESOLUTION PRINTER BOARDS

Top honors on three out of four speed tests go to the LaserMaster Series III Professional board, which benefits from having its own GDI direct-interface language to control the printer. But the other boards are no slouches either. As a rule, they are significantly faster (not to mention less expensive) than the Varityper, a PostScript printer with built-in 600-by-600 resolution.

To measure the performance of these high-resolution printer boards both with simple word processor output and more-complicated desktop publishing tasks, we devised appropriate *WordPerfect* and *PageMaker* documents for separate tests.

Our testbed platform was a 25-MHz Compaq 386 with 6MB RAM, although only the LaserPort PS 600 required this much memory. Connecting each product involved installing a printer board in the computer and cabling it to the same vendor's interface board, inserted into the Optional I/O slot on the rear of the Hewlett-Packard LaserJet Series II. Then we timed the printer output for each file.

Each board converted the file to its highest available resolution—at least 600 dots per inch horizontally—and passed it to

the LaserJet for printing. (To focus entirely on the speed of the boards, we turned the *Windows* print spooler off.)

For the sake of comparison, we ran the same tests while printing directly to the LaserJet, using Bitstream's *Fontware* to create the typefaces for the *PageMaker* document in advance. This produced output at the LaserJet's standard resolution of 300 by 300 dots per inch. For further perspective, we ran the tests once more, printing directly to a Varityper VT600W—the one printer available with a built-in resolution of 600 by 600 dpi, matching the level of output you would expect from the boards we reviewed.

Timing for each test began when the print command was issued, and ended when the printer ejected the last page.

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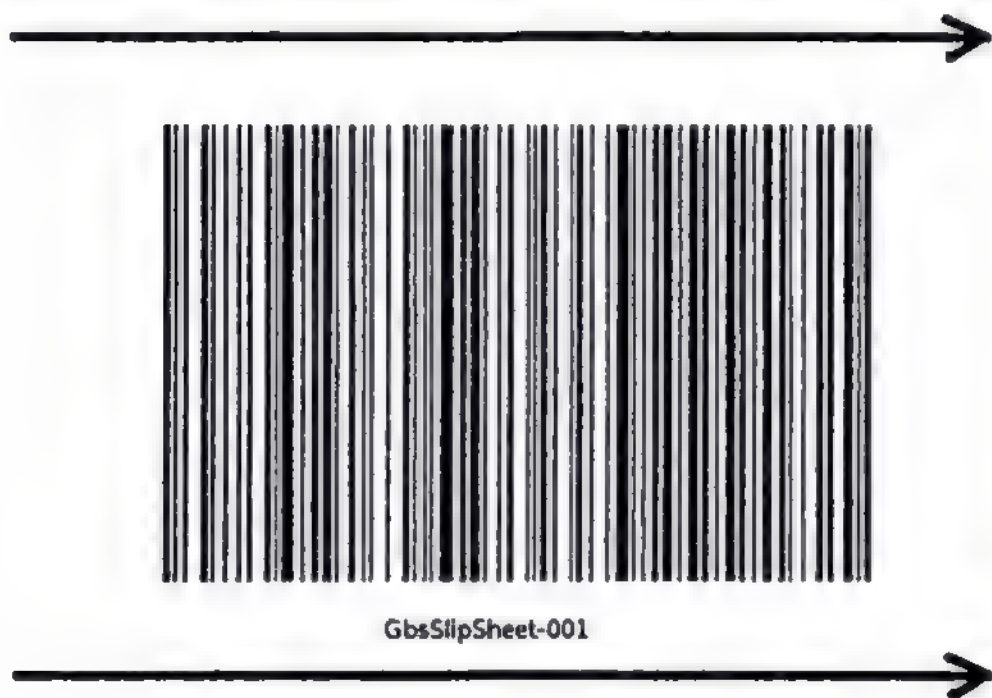
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1. Open the foldout page
2. Insert this sheet with
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3. Slice the folded edge
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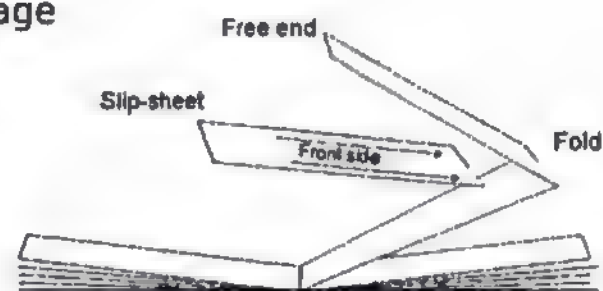
Inverted Foldout slip-sheet



Folded edge of the page

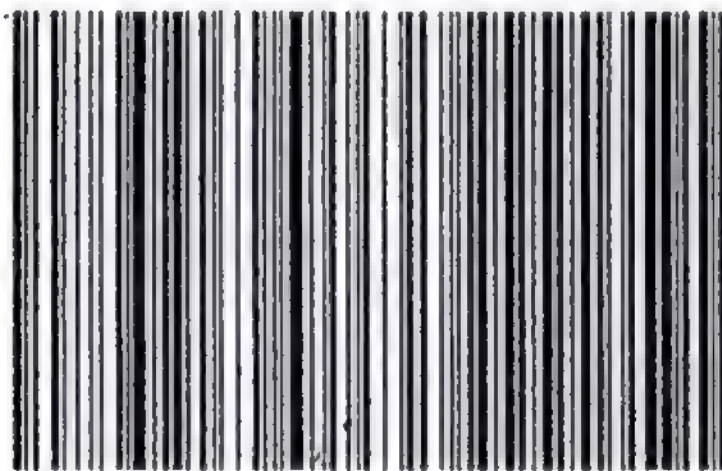
Foldout slip-sheet

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1. Follow instructions on the other side

Inverted Back



Gbs5lpBack-001B

Back

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YES, COMPLETE. \$1395

Editor's Choice! "ZEOS comes in a winner... The fastest SX tested... packing plenty of value... great expandability, quality parts and down to earth pricing... how could you go wrong?" *PC Magazine, Editor's Choice.*

How could we say it any better? You simply can't go wrong. The ZEOS 386SX is the best you can buy.

And right now, you can buy your own *complete* ZEOS 386SX 32MB hard drive system for only \$1,395!

Nothing can touch it. The ZEOS 386SX gives you Guaranteed Value you simply can't get anywhere else. And ZEOS is America's premier '386 systems manufacturer. After all, *PC Magazine* selected ZEOS '386 systems "For Overall Excellence" above all others. But why do they call the ZEOS 386SX "a terrific choice"? Four key reasons:

Performance. Quality.



YOU WANT PERFORMANCE? THIS IS IT!

ZEOS has invested literally thousands of hours creating the world's finest 386SX.

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This is no rehashed '286 design. It's a true '386 from the ground up. A Rock Solid Investment that runs circles around everything else out there.

PC LABS BENCHMARK SERIES

	Instruction Mix	Floating Point Calculation
ZEOS 386SX/16	4.08	6.98
IBM PS/2 Model 55SX	4.46	8.46
Compaq Deskpro 386S	4.48	9.67

QUALITY YOU CAN COUNT ON. ZEOS QUALITY.

Your ZEOS 386SX is designed and manufactured right in our own laboratories. We have used only the *very best* components available. From the power supply right thru to the video, every component is absolute top quality.

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And if you're a VGA buyer you'll absolutely *love* our VGA display. As *PC Magazine* said "the ZEOS VGA display and card prove to be one of the fastest overall... tying with the Compaq Deskpro 386S." Now that's *hot* video!

Even the floppy drive. Yours will be a genuine Teac®. They cost a lot more but you simply can't buy better. ZEOS systems. Quality from the ground up.

AN INCREDIBLE PRICE FOR AN INCREDIBLE MACHINE.

Incredible is the word! How can we build your

10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are bench mark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but three times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent."



Value: Excellent."

Personal Computing said, "ZEOS... is the best value we've come across... its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

Reason #6

24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we're open around the clock. For your convenience. If you buy a product from us we feel we should be there to help, 24 Hours a day. Our Help Lines are Toll Free too. Because you shouldn't have to pay for the call.

Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

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Reason #10

You're Going to be Very Satisfied.

When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, *we Guarantee it!*

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a. Your Personal Information

Requested Line of Credit \$ _____

Your Name _____ Date of Birth _____
First Initial Last Mo. Day Yr.

Present Address _____
Street Apt. # City State Zip

Social Security Number _____ Home Phone _____

Date of Residence _____ Monthly Payment \$ _____ ☐ Buy ☐ Rent ☐ Other
Month Year

Previous Address _____

Dates of Residence _____
From To

Your Employer _____
(If self-employed, see rear panel.)

Date of Employment _____ Position _____
Mo. Yr.

Monthly Income _____
Gross \$ Net \$

Employer's Address _____
Street

City _____ State _____ Zip _____ Business Phone _____

Previous Employer _____ Address _____

Dates of Employment _____
From To

Other Income _____ I have received since (Date) _____
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.

Monthly Income _____
Gross \$ Net \$

Name and Address of Nearest Relative Not Living With You _____

Relationship _____

b. Credit Information

Include joint information, if joint account requested.

Bank Account _____ ☐ Checking ☐ Savings
Bank Name

Address _____

Bank Account _____ ☐ Checking ☐ Savings
Bank Name

Address _____

Bank Loan Reference _____
Bank Name Address

Payment _____ Balance _____

Bank Card Reference _____
Bank Name Address

Payment _____ Balance _____
☐ VISA ☐ Mastercard

(please check appropriate box):

☐ **Joint Credit** with another person. Complete all information.

☐ **Individual Credit** but rely on income or assets of another person as a basis for repaying the credit requested. Complete all information

☐ **Individual Credit** Complete sections "a" and "b" only.

Please complete all appropriate sections, *providing at least two years' residence and employment history*. This will enable your information to be processed as quickly as possible. If you are self-employed, please be sure to complete section "d" below.

Other Credit Card Reference _____
Bank Name Address

Payment _____ Balance _____

Other Credit References _____ Payment _____ Balance _____

Account No. _____ Expires _____

Driver's License No. _____ State _____ Expires _____

c. Joint Personal Information

Joint Name _____
First Initial Last

Date of Birth _____ Social Security Number _____
Mo. Day Yr.

Address _____
Street Apt. #

City _____ State _____ Zip _____

Date of Residence _____ Home Phone (_____) _____
Mo. Yr.

Employer _____

Date of Employment _____ Position _____
Mo. Yr.

Monthly Income _____
Gross \$ Net \$

Employer's Address _____
Street

City _____ State _____ Zip _____ Business Phone _____

d. Self-Employed Information

Complete this section only if you are self employed.

Business Name _____

Business Address _____

☐ Proprietorship ☐ Corporation ☐ Partnership Business Phone (_____) _____

Description of Business _____

Your Position _____ In Business Since _____

Your annual income from business _____ Business' annual income _____
(gross) (net)

You must provide at least one of the following:

1. Business Bank _____

(_____) Telephone _____ Personal Banker's Name _____

2. Accountant's Name _____

(_____) Telephone _____

3. Financial statement on business attached. (EXC. AK, & HI)

ADD-IN LASER BOARDS HI-RES CONTROLLERS

manuals: one for *EiconJet*, one for operation with the HP LaserJet Series II and Canon printers, and one for installation and configuration. There is some redundancy, and you're never quite sure where to find the information you need.

The installation program interactively asks you to specify the type of printer you're using, the I/O port address, the IRQ line, and a memory window. Another program called LPATEST is supposed to help you to determine hardware conflicts, but since the Eicon board accesses the hard disk for fonts and for error log files, window address conflicts can occur that go undetected by LPATEST. We encountered a

doozy, in which *Microsoft Windows* extended memory usage conflicted with the Eicon board's memory window address, causing erratic operation: pages lacked certain fonts, extra form feeds were added, and so on. It took an Eicon technical representative on site at PC Labs, plus hours on a hotline to Eicon technicians in both Canada and California to resolve this particular conflict.

In addition to the 35 built-in Bitstream fonts and the PostScript interpreter, the Eicon software includes hoards of utilities for managing both *EiconJet* and *EiconScript*.

You can add fonts, look at error logs, enter an interactive mode for sending PostScript commands directly to the printer, do batch printing, and more. The software is quite versatile, but the eccentricities of the file-naming conventions, the manual, and the user interface make it a bit hard to use.

Once we finally got it working, the EiconScript's font quality was exceptional. The small-point-size fonts were some of the most attractive and crisp in our collection of products. But it's not enough simply to look good; you've got to act good, too. Products like EiconScript make you wonder whether pretty printing is worth the bother.

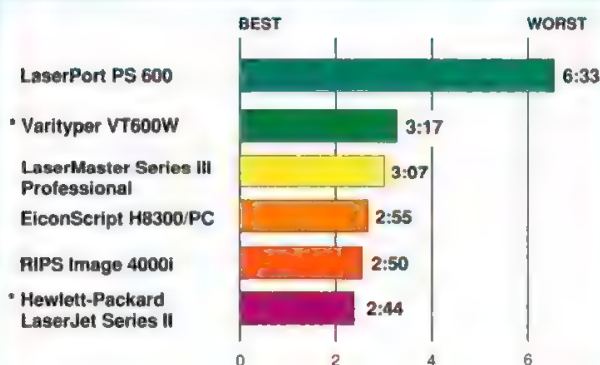


PERFORMANCE TESTS: HIGH-RESOLUTION PRINTER BOARDS

Our **20-Page WordPerfect Document** test measured routine throughput using a standard Courier font. The procedure showcased the board's ability to print typical office paperwork—without any exotic fonts—at increased resolutions.

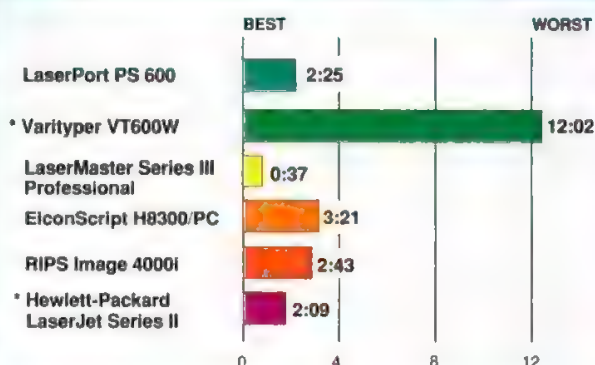
Our **1-Page PageMaker Document** required Times Roman and Helvetica fonts or their equivalents, in sizes ranging from 6 to 36 points. The document also contained a scanned TIFF image 1-bit deep.

20-Page WordPerfect Document Elapsed Time (minutes and seconds)

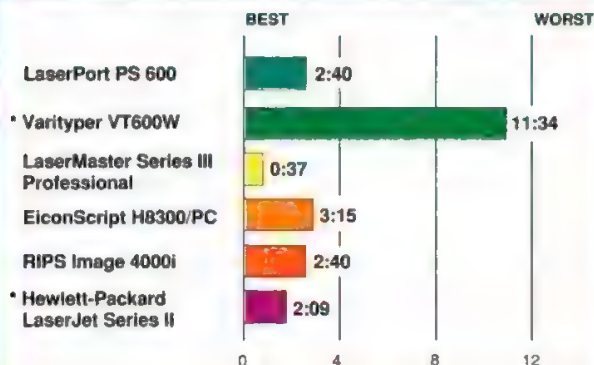


This *PageMaker* document was used in three separate printing tests. The initial run represented a one-time task in which the boards might need to create new bitmaps for each font. We demonstrated the effects of **Font Caching** (storing and reusing fonts) by timing how long it took to print the document once more. Then, to test the speed of printing multiple copies, we told the system to print **Three Copies** of the *PageMaker* document, and we recorded the total time.

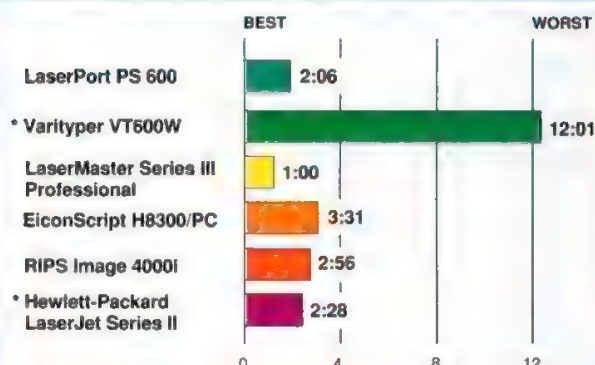
1-Page PageMaker Document Elapsed Time (minutes and seconds)



1-Page PageMaker Document (Font Cache) Elapsed Time (minutes and seconds)



1-Page PageMaker Document (Three Copies) Elapsed time (minutes and seconds)



* Reported for comparison.

CONTINUES

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PC Magazine, November 28, 1989

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Grammatik works inside most popular word processors, including WordPerfect 5.0 and 5.1, Microsoft Word 5.0, WordStar 5.5, Professional Write 2.1 and others. It's as easy to use as a spell-checker. So run your documents through Grammatik and hit a home run.

By Reference Software—512KB, DOS 2.0, Dual, NCP

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Challenge: Ready to take a stab at medicine?

Want to play doctor? You'll find this Life & Death simulation a real stimulation (right down to your pocket pager). Diagnose your patients carefully and analyze the lab work before you make that incision decision. A wrong call and you could wind up back in Med School. Then again, no guts, no glory. So scrub up and bring up the anatomically correct graphics as you malpractice your way to saving lives. Remember, when operating, you need to put the patient under—but not six feet under! After all, what good is a bedside manner at the graveside?

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By **Ashton-Tate**—512KB, DOS 2.1, 5.25"

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CAT Reader OCR Software	■	59600	\$169
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Challenge: Want it as pretty as a picture?

For a perfect letter that's picture perfect, too, choose WordPerfect 5.1. WordPerfect does more than just make sure your words are spelled correctly—it makes sure your pages look great. It gives you professional-looking documents complete with tables and equations—documents worthy of framing. Import spreadsheets and graphics to combine pictures with your thousand words and really get your point across. Other features include menu/mouse support, floating tabs, label creator, and an easier merge function. Too much to learn? Keep it simple with the new context-sensitive help at your fingertips.

By WordPerfect Corporation—384KB, 5.25"

Early Bird Special 60021 **\$245**
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Call Now! Sale price ends 5/1/90.

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Get a grip on your cash flow with Dollars and Sense 3.1. By investing only a few minutes each week, you can cash in on the benefits of financial management without knowing accounting or computing. Complete with running balances and a full range of reports and charts. Performs double-entry accounting, tax forecasting, and *what-if* planning. Then, with your finances straightened out, take the bull by the horns with the new portfolio manager and steer your way up Wall Street.

By Monogram Software—256KB, DOS 2.1, 5.25", NCP

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FASTBACK Plus 2.09	☐	58558	\$105
Lotus Magellan	☐	58546	\$109
Microsoft Windows/286 2.11	■	58015	\$65
Microsoft Windows/386 2.11	☐	58540	\$129
Norton Commander 3.0	☐	58550	\$89
PathMinder 4.11	■	58598	\$49
PC Tools Deluxe 5.5	☐	58567	\$74
PC-FullBak+	■	58607	\$59
Q DOS II	■	58689	\$36
QEMM 386 5.0	■	58690	\$59
The Norton Utilities Adv. Edition 4.5	☐	58536	\$85

Word Processing

Gram-mat-ik IV	☐	60034	\$52
Lotus Manuscript 2.1	☐	60058	\$349
Microsoft Pageview 1.0	■	60059	\$23
Microsoft Word 5.0	■	60002	\$209
Microsoft Word for Windows	☐	60023	\$329
MultiMate Advantage II 4.0	■	60025	\$289
PFS: Professional Write 2.1	☐	60020	\$145
Resume Writer	☐	60047	\$9
RightWriter 3.1	☐	60012	\$49
WillMaker (NOT valid in Louisiana)	■	60054	\$32
WordPerfect 5.1	■	60021	\$265
WordStar 5.5	■	60010	\$229

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ADD-IN LASER BOARDS HI-RES CONTROLLERS

LASERMASTER CORP.

LaserMaster Series III Professional

by Edward Mendelson

Want a printer that does everything PostScript does and more, but does it 5 to 20 times faster? That's what you get when you plug a LaserMaster Series III Professional controller into a slot in your PC and hook it up to the back of a LaserJet via its amazingly thin telephone cable. LaserMaster Corp.'s boards which start at \$1,995 for a model with 2MB of RAM that prints at 400 dpi, may run \$2,995 for 4MB and 800 dpi, and \$3,995 for 6MB and 800 dpi (PS/2 versions cost an extra \$500). Though its price is high, its quality and performance are worth the cost.

LaserMaster uses its own graphics device interface—a direct-interface language called DDPI—to control the printer. (This is the same language that LaserMaster's video boards use to produce a matching screen image.) Although DDPI doesn't support color, it goes beyond PostScript in other ways, supporting transparent graphics and other special effects. The LaserMaster board, unlike any PostScript printer, correctly printed the PC Labs *Ventura* compatibility page. And best of all, you can still use your LaserJet as a normal PCL printer, without thinking twice.

The board (a full-length 8-bit XT-height controller card) comes with four high-density disks, including an effortless installation program, 35 scalable Bitstream outline fonts that use the standard PostScript font widths, drivers for *Micro-*

soft Windows, *Ventura Publisher* and other GEM applications, and *Microsoft Word*. Other applications—including *WordPerfect*, and ZSoft's *PC Paintbrush*

FACT FILE

EDITOR'S CHOICE

LaserMaster Series III Professional

LaserMaster Corp., 7156 Shady Oak Rd., Eden Prairie, MN 55344; (612) 944-9330.

Price: 2MB (400 by 400 dpi), \$1,995; 4MB (800 by 800 dpi), \$2,995; 6MB (800 by 800 dpi), \$3,995. (\$500 additional for PS/2 versions.)

Requires: Hard disk with 3MB free, DOS 3.0 or later, IBM XT, AT, or compatibles, one full-length slot; any laser printer based on the Canon SX engine with an I/O slot.

In Short: Ultrafast, with ultrasharp printing and impressive typographic flexibility, the LaserMaster isn't a standard, but its speed and quality make it superior to the PostScript boards for desktop printing.

CIRCLE 410 ON READER SERVICE CARD



PERFORMANCE TESTS: COMPOSITE VIEW

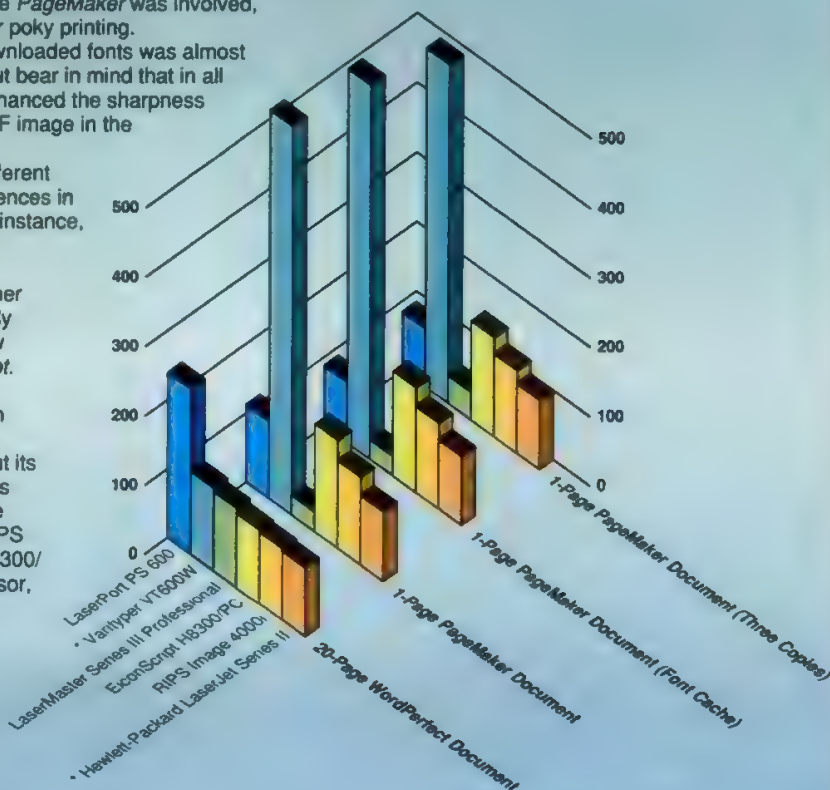
The RIPS Image 4000i and EiconScript H8300/PC boards use their own proprietary form of PostScript, while the other PostScript board we tested—the LaserPort PS 600—comes with QMS's *UltraScript PC Plus*. In all cases where *PageMaker* was involved, PostScript reinforced its well-earned reputation for poky printing.

Even unenhanced, the HP LaserJet II with downloaded fonts was almost always faster than the three PostScript boards. But bear in mind that in all cases, the printer boards' increased resolution enhanced the sharpness of the output; this was especially visible in the TIFF image in the *PageMaker* file.

Each of the three PostScript boards uses a different processor, which accounts for some of their differences in speed. But other factors affect speed as well. For instance, the LaserPort was the fastest of the three in the *PageMaker* application but fell way behind the competition in the *WordPerfect* test (where the other boards achieved scores that compared respectably with the LaserJet's ordinary performance). Its slow *WordPerfect* score was probably due to *UltraScript*. Even so, the LaserPort's performance remains admirable if you bear in mind that it increases both horizontal and vertical resolution.

The RIPS Image 4000i did not really get to strut its high-speed RISC processor; the application drivers appear to slow things down. When you bypass the drivers and print a PostScript file directly to the RIPS board, printing moves quickly. The EiconScript H8300/PC, with its slower Motorola 68000-based processor, took only 5 seconds longer than the RIPS in the *WordPerfect* test but considerably longer in the *PageMaker* tests.

Yet for all-around performance, the LaserMaster Series III Professional is the undisputed speed king. Because the board controls the printer through its own GDI direct-interface language, it readily beats the PostScript boards. The LaserMaster's speed is especially striking because it prints at a resolution of up to 800 by 800 dots per inch—almost twice the resolution of the much slower LaserPort (600 by 600 dpi).



* Reported for comparison

Relative Times
(Hewlett-Packard LaserJet Series II = 100)

ENDS

ADD-IN LASER BOARDS HI-RES CONTROLLERS

as well as some other ZSoft products—come with their own LaserMaster drivers. And a jackrabbit-fast Presentation Manager driver should ship very soon. LaserMaster doesn't have the advantage of being a universal standard like PostScript, but it's supported by a good number of applications in the areas that you're likely to want for high-quality printing.

LaserMaster doesn't have the advantage of being a universal standard like PostScript, but it's supported by a good number of applications.

Running the board is virtually effortless. Initial loading takes less than 5 seconds from your AUTOEXEC.BAT file. The *Windows* and *Ventura* drivers work transparently, but to print with *WordPerfect* or *Word*, you must load a 27K TSR first. In any case, on 386 systems the drivers can be tucked out of DOS's way in high memory. When printing from *WordPerfect* or *Word*, the driver briefly takes over the keyboard while printing, a minor annoyance that LaserMaster says will be fixed in a future version. Unlike the other high-resolution boards in this review, the LaserMaster Series III doesn't take over any of your standard parallel or serial port devices, a minor convenience that LaserMaster thoughtfully included.

QUALITY AND SPEED

LaserMaster uses a proprietary "TurboRes" technology, evidently similar to that used by the DP-Tek LaserPort PS 600, to modulate the printer's laser beam and alter the shape of individual pixels. The result, achieved with the 6MB, 800-dpi board tested by PC Labs, was clearly in the top rank of the four boards tested, equalling or even bettering the Varityper on text and graphics output. TurboRes doesn't affect gray-scale images, but these print at a still-

impressive 800 by 300 dpi.

The Series III's speed is as impressive as its print quality. It flew up to five times faster than the other boards in the single-page *PageMaker* tests, although it scored a few seconds slower than most of the others in the *WordPerfect* 20-page text.

Nothing approaches LaserMaster for typographic flexibility. You can translate any Bitstream *Fontware* or Adobe Type 1 package into a LaserMaster outline font, complete with hints. A *Windows*-based utility (scheduled to ship in March 1990) will let you convert *Digi-Fonts*, *Publisher's Type Foundry*, and URW fonts, and will let you rearrange character sets or even to create composite characters and logos. As we went to press, LaserMaster announced that it will replace its 35 built-in Bitstream fonts with comparable URW

fonts and will throw in an extra 100 URW fonts as well.

With its unmatched speed, print quality, and flexibility, the LaserMaster Series III Professional is an obvious choice for anyone who wants the best available desktop printing—and is willing to pay for it.

RIPS

RIPS Image 4000i

by Robin Raskin

RIPS stands for Raster Image Processing Systems—not Rest in Peace, Sister. But you'll rest easy with this well-behaved board that boosts the resolution of your Hewlett-Packard LaserJet to 600 by 300 dots per inch while offering PostScript printing. (RIPS also makes 300 by 300

UNDER THE MAGNIFYING GLASS

Unless you have lots of time and money, all digital typesetting requires compromises. These samples can help you choose a compromise you can live with. As you can see, there's no clear winner in the quality department; indeed, all the entrants are impressive considering their price.

At the HP LaserJet's standard 300

by 300 dots per inch, you have to live with knobby curves and lines that resemble chicken scratches.

The LaserMaster Series III Professional sample shows some bumpy edges but also has some of the smoothest curves of the group (see, for example, the lower right of the "g" and the upper curve of the "h").

Hewlett-Packard LaserJet Series II

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LaserMaster Series III Professional

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DP-Tek LaserPort PS 600

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ADD-IN LASER BOARDS HI-RES CONTROLLERS

PostScript boards for the HP LaserJet and a variety of boards for Canon printers and engines, including one at 800 by 400 dpi.)

The RIPS system is based on a single-slot board whose smarts come from an Intel i960, a speedy 32-bit RISC processor running at 25 MHz. The board comes with 4MB of memory, expandable to 6MB for additional font caching. Also included is a personality module that plugs into the interface at the rear of the LaserJet Series II, and that is cabled to the interface board with a RIPS-supplied cable.

The RIPS software blessedly comes on one high-density disk that includes the PostScript interpreter, 35 Bitstream fonts, a utility program, and the installation program. The documentation is complete but not gorged. All you need to know is found in 50 well-written pages.

Installation is equally well-designed; the entire process takes about 15 minutes.

The DP-Tek LaserPort PS 600 with *UltraScript PC Plus* takes some odd gaps out of lines and uses angles where there ought to be curves, but overall its output is remarkably smooth.

The EiconScript H8300/PC board shows some clumping on curves and lines but also has some straight verticals.

Before installing the board, you simply run the installation software to determine which parallel port is available for the board (usually it will be LPT2) and to check for address conflicts. I failed to do this at first and it got me into trouble; it's documented, but not stridently enough. And be warned: since there are only two physical addresses that the RIPS board can use (278h and 378h), you may be forced to deactivate or reconfigure one of your other expansion boards.

All this pays off in the end: when you finally install the board, you need only set a single jumper to designate the proper port. In our Compaq machines, the board was a tight but manageable squeeze. Once it's up and running, you can optionally modify your AUTOEXEC.BAT file so that the PostScript interpreter and fonts are down-

The RIPS Image 4000i shows excess inking and is generally too dark, but the level of detail is close to that of the competition.

Like its faster and cheaper cousins, the Varityper VT600W suffers from clumping and irregularities but its finely shaped serifs stand out from the crowd of cheaper solutions. ■

EiconScript
H8300/PC

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RIPS Image 4000i

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Varityper VT600W

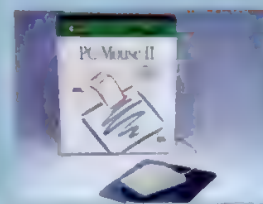
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The Optical Advantage



**PC Mouse II:
The Professionals' Choice.**
Experienced
mouse users
agree that
Mouse Systems'

patented optical technology means smooth, error-free data input. Easy to install and to operate, PC Mouse II offers high reliability at an affordable price.

“What CD does for
your disk, we
do for your desk.”



Performance.
Consider the
advantage of
optical tech-
nology: — no
moving parts
means: friction

free motion, no cleaning, accurate “point and shoot” input, and lifetime guarantee.



**Extra Value
Included**

The PC Mouse II comes packaged with PC Paint Plus, a deluxe paint

program that immediately transforms any DOS user into a computer artist! Also included is the highly acclaimed Mouse Systems Designer Pop-up Menus™ software. And, of course, we include a free MousePad.

PC Mouse II is the only optical mouse that is 100% Microsoft compatible.

See Your Dealer Today!



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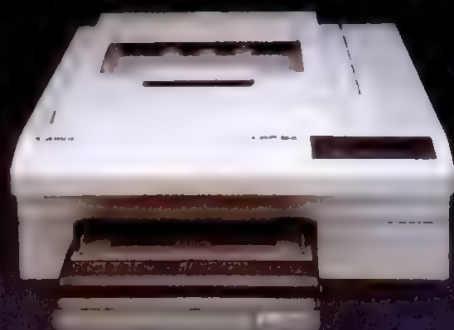
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CIRCLE 116 ON READER SERVICE CARD



Finding the four best
laser printers is easy.
Choosing *which* Canon
to buy is a little tougher.



Come on, now—we can't do *everything* for you. We've produced a complete line of Canon® Laser Beam Printers for crisp text and stunning graphics. We've given them features unmatched in their price range—such as built-in scalable typefaces that look great from the finest fine print to poster-sized headlines—with legendary Canon quality.

But we can't tell you that what you need is the compact size (and compact price!) of the 4-page-per-minute LBP®-4. You're the only one who knows how convenient its 14" x 16" size and quiet operation would be on *your* home or office desktop. And how can we even guess what you'd do with the standard video interface for fast, high-resolution applications?

We're not going to insist that you should get the LBP®-8 Mark III™ for its 8-ppm speed, or for the ability to boost its standard 1.5MB all the way to 4.5MB. Sure, it can accept our IC cards for additional typefaces and capabilities, but so can the others.

Maybe you never need to print letterhead plus second sheets, or long unattended jobs. So why should we brag about the Mark III™, with dual paper cassettes that can hold up to 400 sheets? Just because it can combine portrait and landscape text? Big deal—that's standard for Canon Laser Beam Printers.

And unless you want the ultimate in capability and convenience, you'd have no interest in the Mark III™, with dual cassettes and duplex printing for newsletters, and lengthy reports. Even though, like the others (yawn), it supports all popular word-processing and DTP software.

Visit your Canon dealer—call us toll-free at 1-(800) 733-2900 for the one nearest you. We've done our part, with four Canon Laser Beam Printers that set a new standard.

But the hard part is up to you.

Genuine Adobe® PostScript® is now available for the LBP-8 Mark III Series printers. And it will soon be offered on the LBP-4 printer, as well.



A printer driver kit is provided free with each printer containing all printer definition files currently available on diskette, plus complete installation instructions.

CIRCLE 471 ON READER SERVICE CARD

Canon
LASER BEAM PRINTERS

Working To Improve Your Image.™

From Top To Bottom: LBP® 4, LBP® 8 Mark III™, LBP® 8 Mark III™, LBP® 8 Mark III™

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loaded to the board each time you boot your computer.

The utility, called the RIPS Monitor, is a study in minimalism that would benefit from some minor improvements to the user interface. It lets you download Adobe Type 1 fonts interactively, send PostScript commands directly to your printer, and send batches of PostScript files. Yet, even though there are only nine menu items, you must type an uppercase R for Resume printing and a lower case r to reset the processor. What potential for disaster! And the main menu cannot be on the screen while you are processing, a tidbit that doesn't become apparent until the first time you wait agonizingly for a printout.

But these are picayune problems; the larger issues are well resolved. The RIPS produces nicely shaped high-resolution text that's crisp and legible even at the smallest point sizes. It worked well with a variety of PostScript drivers for different printers, including the QMS and the Apple LaserWriter. And, when you need to use your printer as a regular LaserJet, RIPS does not interfere.

I was able to download Adobe PostScript fonts for use with *PageMaker*, but it wasn't easy. The RIPS manual should make a point of documenting this intricate process. Incidentally, the downloaded fonts use Adobe's built-in hints for the 300-dpi vertical resolution and also use hints built into the board itself, so they look good.

The board currently uses the *Microsoft Windows* PostScript driver, which, according to the manufacturer, doesn't take advantage of the processor's inherent

ADD-IN LASER BOARDS

HI-RES CONTROLLERS



EDITOR'S CHOICE

• LaserMaster Series III Professional

The three reasons to buy an add-on controller for the Hewlett-Packard LaserJet are enhanced print quality, speed, and flexibility. The LaserMaster Series III Professional produces startlingly sharp, clear text and line art at a speed that no other desktop printer can approach. It can use both Bitstream and Adobe fonts at 800 by 800 dots per inch, and, by the time you read this, will ship with a cornucopia of 135 URW fonts. The LaserMaster is now a mature product with easy installation and a helpful supply of utilities.

Although the LaserMaster works smoothly with most major applications (and now has an ultrafast Presentation Manager driver), it can never become a universal standard like PostScript. If you insist on standards, your best choice for high-resolution desktop PostScript is the RIPS Image 4000i. This high-quality option has good performance, supports both Bitstream and Adobe fonts, and is easy to manage—unlike the quirky EiconScript.

For sheer technical excellence, the DP-Tek LaserPort PS 600 deserves a mention. Its 600- by 600-dpi output is impressively sharp, and it costs somewhat less than its competitors. But these benefits are offset by its installation headaches, its very high RAM requirements, and by the limited number of fonts that its *UltraScript* PostScript interpreter software supports.

speed. RIPS is designing a new *Windows* driver to increase performance. In the meantime, our benchmark testing found the RIPS board to be only a tad slower than the HP LaserJet; excellent, considering its much better output. And the RIPS Monitor offers a speedier alternative if your patience runs thin.

At \$3,000, your bank account might not rest as easily as your mind. But RIPS gives you real value for all those dollars. ■

Edward Mendelson and Robin Raskin are contributing editors of PC Magazine.



FACT FILE

RIPS Image 4000i

RIPS, 4665 Nautilus Court South, Boulder, Colorado 80301; (800) 223-3467, (303) 530-2910.

Price: 3MB (300 by 300 dpi), \$1,950; 4MB (400 by 400 dpi), \$3,000; 4MB (600 by 300 dpi), \$3,000; 6MB (800 by 400 dpi), \$5,000.

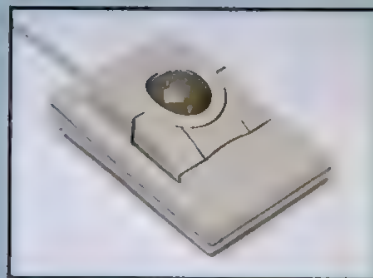
Requires: Hard disk with 1MB free disk space, DOS 2.0 or later. IBM XT, AT, or compatibles, IBM PS/2 Model 25 or Model 30, a full-size expansion slot, one parallel port, I/O slot in printer; HP LaserJet Series II; Canon LBP-11/II, Canon 300SX, 400SX, LBP-20; most Canon laser printers and Canon SX engines supported. MCA version soon to be available.

In Short: Easy installation, good performance, and attractive 600 by 300 resolution make this board an appealing choice for those who require PostScript.

CIRCLE 411 ON READER SERVICE CARD

NEW!

When a mouse doesn't solve your computer interface needs then Mouse Systems' PC Trackball is the answer.



'Move Over Cheese-Eater'

The Mouse Systems PC Trackball

- Consumes less desk space
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Includes Mouse Systems Productivity Software:

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Every Mouse Systems PC Trackball is bundled with **The Presentation Magician**. This presentation graphics and paint package will give your business graphs and charts visual punch with:



- ability to import data from a wide range of spreadsheets and databases.
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CIRCLE 120 ON READER SERVICE CARD

INTRODUCING WIZ



WIZ is an exciting new productivity tool. It combines the easy-to-use features of a mouse with the power of an intelligent graphics pad to enhance every pointing, tracing and drawing function you do.

And it gives most Mac and PC users a short cut through tedious keystrokes and menu picking steps. So it's easier for new computer users to learn both the system and the software. While experienced users immediately become more productive, powerful and creative.

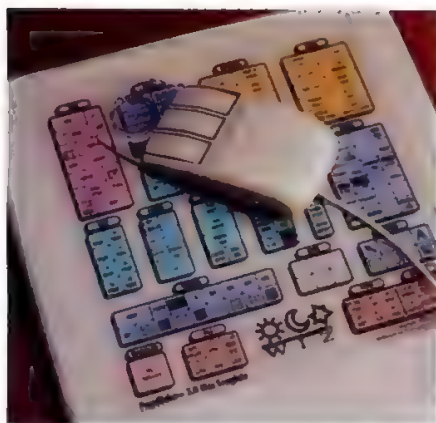
But the most amazing thing about WIZ is that you get it all for a suggested retail price of under \$250.

Features/Benefits

6 programmable functions. The three WIZ mouse rocker buttons allow you the flexibility and convenience to program up to four different commands or macros. Two others control your mouse and template clicks.

Speed. WIZ eliminates the need for scrolling through multiple on-screen menus or remembering the many keyboard commands used by software packages. Programmable buttons and templates allow instant access to commonly used software commands.

Pinpoint accuracy. WIZ is the most accurate mouse system on the market, with 1000 dots per inch (dpi) resolution, compared to as much as 400 dpi offered by other mouse manufacturers. The very high accuracy of the pad, combined with the cross-



hairs on the mouse and the optional pen, make WIZ excellent for drawing and tracing. **Reliable.** WIZ has no mechanical parts. It is all electronic, so there are no parts to clean or maintain. No rolling ball or moving parts on the mouse. WIZ is the most reliable system you can get.

Adjustable pad scaling. WIZ allows you to define the portion of your intelligent pad's active area which corresponds to your computer screen. This is especially beneficial in drawing and tracing applications.

Templates offer direct access to commands. Optional templates, available for most major programs, fit on top of your intelligent pad. The color-coded WIZ templates place software commands at your fingertips, eliminating tedious pull-down menus and keystrokes.

Software compatibility. Works with most of the popular mouse-driven software. Full Microsoft and Apple mouse compatibility.

Small footprint. It's the same size as an ordinary mouse and pad. 7.5" square active area. The overall size is 9.5" x 11.8".

Easy to install. Works on IBM and compatibles plus Macintosh II and SE computers. WIZ plugs right into your mouse, serial port or ADB, (depending on your system). You're up and running in just a few minutes.

Complete system. WIZ comes complete with a WIZ mouse and intelligent pad, interface cables, drivers, operating system template, User's Guide and a 5-year warranty.

Support. WIZ is manufactured by CalComp, a world leader in computer graphics for over 30 years.

Who can use WIZ?

Anyone who is now using a mouse or thinking about using one including:

Business professionals can use WIZ with all their applications to help save time when creating presentations and business forms, including spreadsheets and graphics.

Graphic artists can use WIZ to assist with the creation of simple to sophisticated designs and graphics.

Electronic publishers, both professional and occasional, can use WIZ to help speed the creation of a variety of professional-looking documents such as newsletters, flyers, pamphlets and stationery.

Engineers and architects can use WIZ as a CAD tool for conceptual designs and technical drawings.

Writers and journalists can use WIZ to assist in the creation of articles, manuscripts or stories.

Options

WIZ Pen

Creative alternative. When you prefer the feel of a pen over a mouse. It's great for menu-picking, drawing and tracing, as well as controlling screen cursor movements. Plugs right into the back of your pad.

2 Buttons. Use the button in the tip to menu pick, draw and trace—can use for all your mouse functions too. The side button allows you to make template command selections.

Suggested retail price of \$75



WIZ Software Application Templates

Enhance productivity. When you want speed and power, use the WIZ mouse or pen and intelligent pad with a template. WIZ comes with a standard template for your computer's operating system. Plus there's a variety of optional templates for the most popular software packages, which makes using packages quick and easy.

Easy to use. The color-coded templates come complete with easy to install software and instructions.

Templates

Over 35 optional software templates are available for most IBM and Apple packages, including:

Aldus PageMaker
WordPerfect
Harvard Graphics
Microsoft Excel
Claris MacDraw II

Availability and Support:

See WIZ today at your local computer store or dealer.

If your dealer doesn't have WIZ in stock, he can order it through our distributor Ingram Micro D by calling **800-456-8000**.

For product information on WIZ call CalComp at **800-458-5888**.

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By CalComp

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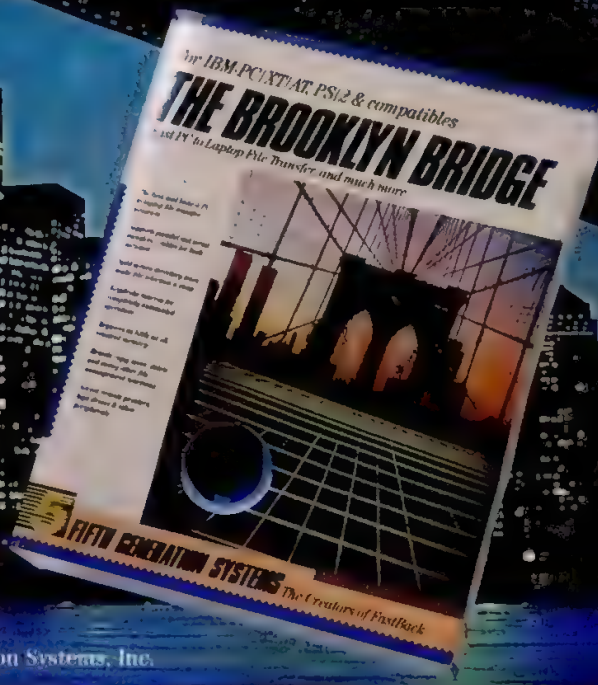
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Barry L. Bellue
President and C.E.O. of Fifth Generation Systems, Inc.



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10049 N. Reiger Road Baton Rouge, LA 70809 (504) 291-7221

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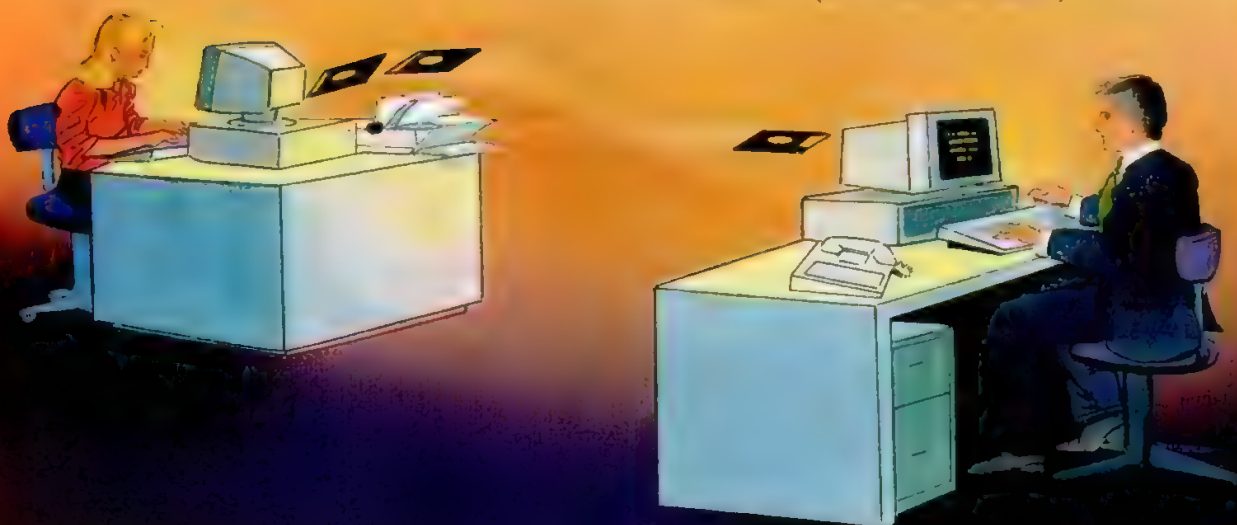
ZERO-SLOT LANS

by Kimberly Maxwell and Patricia A. McGovern

Need to share disk drives and printers among a few PCs? If your requirements are modest and your budget tight, a zero-slot LAN may be your answer.

Zero-slot LANs (a term *PC Magazine* coined in 1985 to describe the technology) communicate using your computer's existing serial or parallel ports instead of extra-cost adapter cards, interconnecting your PCs with simple cables or RJ11-type telephone wire. While they're limited in performance and expandability, zero-slot LANs don't just pinch your pennies but make them scream.

Zero-slot LAN prices range from about \$100 to \$400 for products connecting two or three stations. This stands in sharp contrast to even low-cost media-shared LANs such as *LANtastic* or *ELS NetWare* (see "Low-Cost LANs," *PC*



CONNECTIVITY

ZERO-SLOT LANs

Magazine, March 28, 1989), whose adapter cards and special cabling bring their cost up to \$300 to \$600 per node. Data switches (see "Data Switches: A Low-Cost LAN Alternative," *PC Magazine*, July 1989) can save money on larger networks because they don't require adapter cards. But the cost of the switch makes this an expensive alternative for small networks with few stations over which to spread the investment.

The trade-off, of course, is in performance. In the other alternatives, the network adapter or the data switch takes care of sending and receiving signals over the network cable. But with a zero-slot LAN, the PC's processor must attend to all the network communication tasks, distracting it from processing the foreground application's workload. Zero-slot LANs quickly bog down if more than two workstations attempt to use them simultaneously.

GOOD THINGS IN SMALL PACKAGES

Given this low-rent orientation, it's not surprising that zero-slot LANs fit best into the two-station "boss/secretary" model, where their low cost is a big attraction and their relatively slow performance is no hindrance. Once you start looking, you'll be surprised at what you'll find in the way of features, from full-featured print spooling and electronic mail to support for file and record locking, NetBIOS, and CD-ROM drives. You don't have to give up on these

conveniences just because your network is small.

Best of all, the makers of zero-slot LANs have learned a lesson in aesthetics since our last look at them (see "Making Connections: Zero-Slot LANs," *PC Magazine*, June 23, 1987). Most come bundled with cables (often thin, flexible, easy-to-hide wires with telephone-type jacks), so they're ready to plug in and start working right out of the box. By and large, today's software installs more easily than yesterday's, and once installed, it operates almost invisibly.

REVIEW CRITERIA

In this review, we cover five packages that connect two or more workstations over serial or parallel ports (or both), allowing you to share printers and disks and to send messages between them. Within this group, you'll find significant variations in capability. *DeskLink* from Traveling Software and *MasterLink* from U.S. Marketing are basic two-station LANs with simple features. The more robust *LANtastic /Z* from Artisoft and *Printer LAN* from Grapevine LAN Products offer an intermediate approach, with many of the management and security options of a larger network. And finally there is The Software Link's *LANLink 5X*, a full-blown networking system that can handle up to 16 users in

a wide variety of configurations.

One thing they all have in common is virtual drives, meaning that a workstation can address the drives on a remote PC simply through additional drive letters. This lets you use standard DOS commands and batch files to access and manage files and makes it possible for ordinary DOS applications to read and write files on remote disks. We think that a modern zero-slot LAN should have this feature, so in this issue you won't find Server Technology's *EasyNet 2*, (the descendant of *EasyLAN*, one of our former favorites), because it never evolved to include virtual drive capability.

Network-EZ, a serial-port adaptation of *Network-OS* from CBIS, reached us too late for review. It offers electronic mail, CD-ROM support, and modem sharing for \$420. The latest version of *3X-Link 16* from 3X USA was also supposed to meet our criteria, but it was not available in time for our deadline.

AN ALTERNATIVE?

In the heat of competition, some file transfer packages that began life as bridges between laptops and desktop systems have been enhanced to include virtual drive and printer-sharing capabilities similar to those of zero-slot LANs (see the sidebar "Not Quite a Zero-Slot LAN?"). But unlike true zero-slot packages, which can share disks and printers in the background, these prod-

ZERO-SLOT LANs: SUMMARY OF FEATURES

Products listed in ascending price order

	MasterLink	DeskLink	LANtastic /Z	Printer LAN	LANLink 5X
List price	\$149.50	\$169.95	\$199.00	\$295.00	\$395.00
BASIC INFORMATION					
Maximum number of stations	2	2	2	3	16
Maximum number of printers	8	4	4	5	4
Supports serial connections	■	■	■	■	■
Supports parallel connections	□	□	■	□	□
Requires dedicated server	□	□	□	□	■
MEMORY USAGE					
Workstation RAM (without expanded memory)	75K	143K	26K	64K-128K	32K
Supports expanded memory	■	■	□	■	□
Supports NetBIOS	■	□	■	■	□
Supports CD-ROMs	■	□	■	□	■ (with driver)
Requires change to CONFIG.SYS	■	■	■	■	■
NETWORK FEATURES					
Print spooling	□	■	■	■	■ (with PC-MOS)
Chat feature	□	■	□	□	□
Electronic mail	□	□	■	■	□
Menu program	□	■	■	■	□
Help screens	□	■	■	■	□
Security	■	□	■	■	■

■—Editor's Choice ■—Yes □—No

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LAN TIMES
**READERS
CHOICE**
1989



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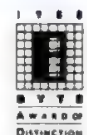
And only LANtastic gives you a special windowed menu that will lead you by the hand through the set-up process. So you can be up and running before lunchtime.



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PERFORMANCE TESTS: ZERO-SLOT LANS

Parallel connections offer considerably greater throughput than serial connections. But there are significant variations among the products in each group, which we attribute to differences in the way the programs address the ports. Software techniques do make a difference.

Products that can take advantage of parallel connections show significant throughput advantages for application programs using the network's virtual drives. With *LANtastic /Z*, for instance, it would take about 6 seconds for a DOS Copy command to deliver a 50K file to your desktop machine using a parallel connection,

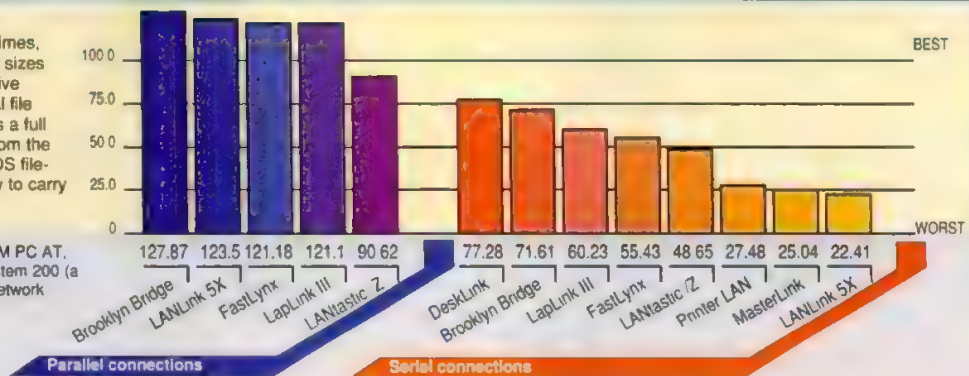
compared with about 12 seconds using a serial connection. Using the parallel port ties up the usual printer connection and requires larger and costlier cables, but it certainly provides better performance.

System Throughput

(kilobits per second)

The **System Throughput** test manipulates a 1MB file fifteen times, using three different data block sizes (512 bytes, 4K, and 16K) and five different random and sequential file actions. In this way it measures a full range of system capabilities, from the redirector's ability to handle DOS file-open calls to the media's ability to carry the data.

The test was run on an 8-MHz IBM PC AT, accessing the drive on a Delt System 200 (a 12-MHz 286 machine) over the network.



ucts have resource-sharing software that runs in the foreground, preventing a given machine from being used for anything else while sharing its disks and printers with the network. Consequently, though they can be handy for temporary lash-ups between two workstations or for intermittent use, these programs are unsuited for permanent installations.

SERIAL AND PARALLEL

The major limitation of zero-slot LANs in the past has always been the relatively slow speed of the serial links between the workstations. Though these can be (and are) tweaked up to a rate of 115,200 bits per second over short distances (about a third of the speed of a floppy disk drive), this is a far cry from Ethernet's peak rate of 10,000,000 bits per second or ARCnet's 4,000,000 bps.

LANLink 5X and *LANtastic /Z* squeeze a little more juice out of the standard equipment on your PC by transmitting data through the parallel port. If you have the option, parallel links offer much better throughput than serial links from the same program; they're almost twice as fast with

LANtastic /Z, and more than five times as fast with *LANLink 5X*, to judge by our performance tests.

But raw speed isn't the only consideration. The throughput of a parallel transfer depends on the speed of your processor and on your parallel port hardware, so if your machines are slow, you may not get as much of a boost as you expect. Parallel cables are bulkier than serial cables, and since the maximum run of a parallel cable is a good deal shorter than the maximum run of a serial cable, you may not be able to use a parallel link. Finally, most PCs come equipped with only one parallel port, so using it for the LAN means you can't use it for a printer.

PLANNING AHEAD

Your future plans should be a consideration in your decision as well. *LANLink 5X* can support up to 16 workstations on a single server, and *MasterLink* can be expanded to up to ten stations by upgrading to *ZeroNet*. But keep in mind that performance degrades drastically when more than two PCs are using the network simultaneously. Most of the zero-slot LAN prod-

ucts we tested are sensibly aimed at networks of no more than two or three stations, and if you expect to need more than this, a low-priced media-shared LAN will suit you better in most cases.

For the same reason, zero-slot LANs are not suited for use with multiuser programs like database managers. Though some of the networks we review do support the DOS file- and record-locking functions, this complex exchange of information tends to bog down over the relatively slow links that zero-slot LANs provide. You may be able to get practical performance over parallel links, but if your network uses serial links, these LANs won't be a good solution for such shared-file applications.

On the other hand, the ability to respond to Netbios calls from application programs is worth having. This feature lets you use SNA gateways, LAN remote-control software (see "The LAN's Helping Hand," *PC Magazine*, October 31, 1989), certain e-mail packages, and asynchronous communications servers over your zero-slot network. The slowness of zero-slot LAN products isn't a limitation for

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CONNECTIVITY ZERO-SLOT LANS

these applications, because most of them rely on even slower modem links to get the job done. Network awareness brings another plus: often you can use a zero-slot LAN to add a station to a larger network quickly and cheaply by linking it to an existing workstation on the larger LAN over a low-cost serial or parallel link.

PRINTER SHARING AND E-MAIL

If today's zero-slot LANs don't shine performance-wise, they hold their own when it comes to features. All the packages let you share printers, and most of them offer true print spooling, which gives you individual control over your print jobs and lets you cancel or reprioritize them as necessary. *Printer LAN* is particularly adept in this respect; it lets you store the spool files on any workstation with a hard disk, regardless of where the printer it is feeding is attached—a plus if not all of your workstations have hard disks.

Printer LAN and *LANtastic /Z* offer true store-and-forward electronic mail as well,

giving your small network many of the same messaging capabilities as large systems. With these programs, you can attach binary files such as worksheets and formatted word-processor files to your mes-

**Today's zero-slot
LANs hold their own
when it comes to
features.**

sages, which is often an easier way to transfer files than copying them directly.

DeskLink does not have electronic mail, but it does have a chat feature that lets you send a short message to the other

station immediately. This can be very handy for notifying the other person of an incoming phone call, or for having a running discussion. *Printer LAN* has a quick "notepad" feature in its e-mail system that offers a similar convenience, though without the real-time response.

SECURITY CONSIDERATIONS

The last thing to consider is security, which in turn depends on how you want to organize your work. In many sites, security isn't an issue; neither workstation has sensitive information on it, and pooling resources is the primary goal. In such cases, passwords and privilege levels are merely burdensome, and a product like *DeskLink* that eschews them will be an attractive choice.

Yet often there is a real need for security, even in small networks. For example, you may want to reserve part of your hard disk as a private storage area while sharing the rest of it with the network. Or you may want to let your secretary or assistant use

NOT QUITE A ZERO-SLOT LAN?

by C. G. Milligan

When is a zero-slot LAN not a LAN? The zero-slot packages in our review are all intended for permanent installations of two or more workstations. But if your needs are satisfied by occasional disk and printer sharing and you don't need a full-fledged LAN, some file transfer packages offer an inexpensive yet effective alternative.

Three of them—Fifth Generation Systems' *Brooklyn Bridge* (\$139.95),

Rupp Corp.'s *FastLynx* (\$149.95), and Traveling Software's *LapLink III* (\$149.95)—come with software and device drivers that allow a single operator to access a remote computer's disks as virtual drives, and to use its printers.

Unlike the true zero-slot LANs in our review, which run their resource-sharing software in the background, these products operate in a master/slave relationship, with a single master workstation using the resources of one or more remote computers. Each remote computer runs its resource-sharing software in the foreground, preventing it from being used for anything else at the same time. The master workstation accesses the slaves' devices through device drivers. When the resource-sharing software isn't running on the slave, both computers can operate independently, but the network connection isn't enabled.

THREE OR A QUARTER DOZEN

In their basic outlines, these packages are quite similar. All have some form of automated driver installation, so you don't have to struggle with cryptic DEVICE statements in the CONFIG.SYS



FACT FILE

FastLynx,
Version 1.01
Rupp Corp., 7285
Franklin Ave., Los
Angeles, CA 90046;
(800) 852-RUPP,
(213) 850-5394.
List Price:
\$149.95.
Requires: DOS 2.0 or later, serial or parallel
port on each workstation.
In Short: *FastLynx* is very easy to install and
use, with a well-designed program to guide
you through installation and configuration. It
supports parallel as well as serial
connections and has good printer support.

CIRCLE 602 ON READER SERVICE CARD

file on the master workstation, at least for relatively simple installations. All support DOS Versions 2 through 4, though interconnecting machines with different DOS versions will impose some limitations on sharing hard disks. All come with good documentation and free technical support by telephone. And all come with serial and parallel cables that you can use to connect the workstations over short distances.

FastLynx is the simplest to install



FACT FILE

LapLink III,
Version 3.00
Traveling Software
Inc., 18702 N. Creek
Pkwy., Bothell, WA
98011; (800) 662-
2652, (206) 483-
5555.
List Price:
\$149.95.
Requires: DOS 2.11 or later, serial port on
each workstation.
In Short: A pop-up control window lets you
change drive assignments as well as printers,
but restriction to serial connections is a
performance handicap.

CIRCLE 603 ON READER SERVICE CARD

CONNECTIVITY

ZERO-SLOT LANS

your printer while preventing him or her from accessing your hard disk. And if snoopers are a problem, you need the user accounts and log-on passwords of a full-scale security scheme.

If your security needs aren't complex, *MasterLink* and *Printer LAN*, which let you reserve areas of your disk in the configuration phase, will serve quite well without imposing the trouble of creating and maintaining user accounts. But if you really need more, *LANLink 5X* and *LANtastic /Z* offer full user account structures, with setup menus that allow you to determine the various log-on passwords and directory privileges.

IS IT FOR YOU?

While not the leading edge of network technology, zero-slot LANs can serve admirably in small offices, where they simplify the tasks of transferring files and sending jobs to a shared printer. If your data- and printer-sharing needs are not heavy, one of these products may be your

easiest and least expensive road into the networked world.

But remember that zero-slot LANs do make trade-offs between performance and cost. If you ever anticipate adding more than three stations to your network, you may be better off making the investment up front in a low-cost media-shared system like *LANtastic*, which not only gives you much more room to grow but frees up your serial ports for modems as well.

DeskLink

by Patricia A. McGovern and
Kimberly Maxwell

For some time now, *DeskLink* has been a good way to tie together a couple of PCs and their peripherals easily and inexpensively. This \$169.95 program connects two PCs up to 100 feet apart over ordinary

null-modem or RJ11 phone cable, giving each one full access to the other's disk drives and attached printers. Though somewhat limited in features and expandability, *DeskLink's* practically invisible operation makes it a product to consider for any two-station network.

Installation is a simple matter. After connecting the two stations together, you need only copy some software, add *SHARE.EXE* to your *AUTOEXEC.BAT* file, and run the *DESK* program on both workstations to make the connection. A helpful menu (available from the command line or through a user-definable hot-key) makes it easy to change such details as which local or remote printer to use and which letters you want to assign to the remote workstation's drives. If you get stuck, *Traveling Software* offers unlimited technical support.

DeskLink performs its chores in the background, and it exacts a fairly hefty price to do so—about 143K. Fortunately, a command-line switch lets you load about

and use, especially for novices. Its "expansion box" program not only acts as the host program but automatically detects the port you're using and guides you through the device-driver installation options with simple prompts and an abundance of help screens. The expansion box works with parallel connections, and its optional turbo serial mode, which uses a technique similar to those used in advanced modem protocols, boosts throughput on these connections (though this may cause problems with timing-sensitive devices). *FastLynx* can be set up so that if the remote printer is busy the job will be routed to the local one, and vice versa.

LapLink III's command-line mode also has automatic port-selection capability and a turbo speed setting on serial transfers, but you'll have to sacrifice the speed of a parallel connection, as *LapLink III's* command-line mode works only over serial connections. Its device driver does let you pop up a small control window to configure the drive letters for remote disks and to select a local or remote printer. Unfortunately, *LapLink III* doesn't seem to like disk-caching programs, and it also ran

into problems with memory-resident programs like *Sidekick*, *Lotus Metro*, *WordPerfect Library*, and some mouse drivers.

POWER VERSUS SIMPLICITY

Of the three, *Brooklyn Bridge* from Fifth Generation Systems offers the most sophisticated command-line mode. Unlike the others, it lets a single

master workstation use devices from more than one slave, so that you could, for example, share the disk of one computer and the printer attached to another. It comes with a number of DOS command-line utilities and diagnostics, many of which are handy for local use as well as for automating file transfer and other network tasks.

The downside of this power is complexity. *Brooklyn Bridge's* device-driver scheme is convoluted, and installing more than a few devices is not for the uninitiated. The device drivers and host program both suffer from awkward design; if you want to use COM3 or COM4, if you want to run at less than the maximum serial transfer rate of 115,200 bits per second, or if you use a nonstandard serial-port address, you'll have to patch the executable code.

Each of these packages has its better points, but any one of them can serve if you need an affordable solution to occasional file-transfer and printer-sharing problems—and don't care about advanced features like electronic mail. When you need access to another computer's resources, there is no simpler answer.

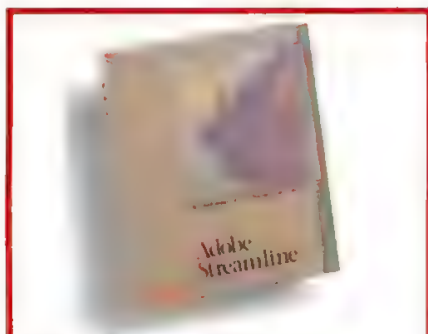


FACT FILE

Brooklyn Bridge, Version 3.0
Fifth Generation Systems Inc., 10049 N. Reiger Rd., Baton Rouge, LA 70809; (800) 873-4384, (504) 291-7221.
List Price: \$139.95.
Requires: DOS 2.0 or later, serial or parallel port on each workstation.
In Short: An advanced command-line mode makes this the most powerful but also the most complex of these packages, and the most difficult to install. High performance and a good selection of DOS utilities make it worthwhile for the DOS-initiated.

CIRCLE 001 ON READER SERVICE CARD

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1332	☐PageMaker 3.0. 499.
Alpha Software ... NCP	
5104	☐Alpha Four 1.1. 319.
4103	☐Alpha Works 2.0. 89.
Application Techniques ... NCP	
1214	☐Pizazz Plus 1.3. 69.
Ashton-Tate ... NCP	
4450	☐dBASE IV 1.0. 499.
Autodesk ... NCP	
4519	☐Autosketch 2.0. 95.
6119	☐Autosketch Animator 1.0. 189.
Avery ... NCP	
6006	☐Label Pro 1.0. 49.
Bitstream ... NCP	
☐Fundamentals:	
Reports and Proposals, Presentations	
or Spreadsheets. each 159.	
☐Headlines (1 to 6). each 99.	
☐Individual Fonts. each 99.	



Alpha Software ... NCP

☐ **Alpha Four 1.1**—The award-winning fully relational database management & application development system for business people, not programmers. Offers sophisticated reports and customized applications. \$319.

Bloc Publishing ... NCP	
1447	☐FormTool 2.01. 55.
6245	☐PopDropPLUS 1.0. 59.
Borland International ... NCP	
4330	☐Turbo C Professional Pack 1.0. 175.
4332	☐Turbo Pascal Professional Pack 1.0. 175.
6242	☐Quattro Pro 1.0. 289.
1514	☐Paradox 3.0. 469.
Brightbill-Roberts ... NCP	
5408	☐Hyperpad 1.0. 89.
5843	☐Show Partner F/X 3.5. 229.
Broderbund ... CP	
1434	☐New Print Shop (NCP). 39.
1433	☐Memory Mate 3.01 (NCP). 45.
ButtonWare ... NCP	
6419	☐PC-File 5.0. 75.
Caere ... NCP	
6004	☐OmniPage 386 2.1. 599.
Central Point ... NCP	
5039	☐PC Tools Deluxe 5.5. 77.
5038	☐Copy II PC 5.0. 27.

Chipseoft ... NCP	
1663	☐TurboTax for 1989 Taxes 7.0. \$45.
☐Individual States. each 34.	
Chronos Software ... NCP	
4387	☐Who•What•When 1.09. 119.
Concentric Data Systems ... NCP	
6575	☐R & R Relational Report Writer 3B. 109.
Corel Systems ... NCP	
5506	☐Corel Draw 1.1. 329.
Crosstalk Communications ... NCP	
2908	☐Crosstalk XVI 3.7. 109.
5611	☐Crosstalk for Windows 1.0. 129.
DacEasy ... NCP	
1748	☐DacEasy Accounting 4.0. 89.
Data Storm ... NCP	
4798	☐PROCOMM PLUS 1.1. 52.
Delrina Technology ... NCP	
4325	☐PerFORM 2.0. 169.
Delta Technology ... NCP	
5829	☐Direct Access 4.1. 52.
Digital Composition Systems ... NCP	
5876	☐db Publisher Report Maker 2.0. 185.
Dow Jones ... NCP	
5494	☐News/Retrieval Membership Pkg. 24.
5th Generation ... NCP	
2762	☐Mace Utilities 1990. 89.
3950	☐Fastback Plus 2.09. 109.
FormWorx ... NCP	
5810	☐FormWorx with Fill & File 2.5. 85.
Fox Software ... NCP	
6188	☐FoxPro 1.0. 489.
2233	☐Foxbase Plus 2.1. 199.
Funk Software ... NCP	
2228	☐Sideways 3.21. 42.
4479	☐Allways 1.0. 85.
Generic Software ... NCP	
2265	☐Generic CADD Level 3 1.13. 169.
Great American Software ... NCP	
4880	☐One Write Plus Accounting Sys. 2.0. 179.
5825	☐Money Matters 1.0. 55.
Harvard Associates ... NCP	
2324	☐PC Logo 3.0. 59.
Hayes ... NCP	
2293	☐Smartcom II 3.0. 89.



Microcom ... NCP

☐ **Carbon Copy Plus 5.2**—Links two PCs, their keyboards, screens, and disks. You can have complete control of a remote PC's application software from your own PC. \$115.

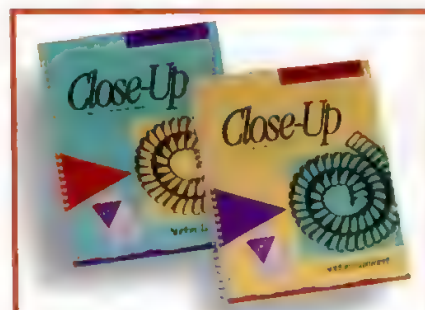
April 15th means money.

Hilgraeve ... NCP	
2323	HyperACCESS/5 1.0 (DOS & OS/2) \$115.
IBM ... NCP	
6187	Storyboard Plus 2.0 239.
6599	Current 1.0 239.
Individual Software ... NCP	
2408	Professor DOS 4.0 27.
6222	Resume Maker 1.0 29.
Intuit ... NCP	
2426	Quicken 3.0 39.
Lord Publishing ... NCP	
5191	Ronstadt's Financials 1.02 145.
Lotus ... NCP	
5417	1-2-3 3.0 call
5653	1-2-3 2.2 call
5134	Magellan 1.0 149.
4131	Agenda 1.0 275.
2660	Freelance Plus 3.01 345.
MECA ... NCP	
4603	Andrew Tobias' Tax Cut 1989 45.
2798	Managing Your Money 6.0 119.
Microcom ... NCP	
2775	CarbonCopy Plus 5.2 (2 req.) 115.
Micrografx ... NCP	
6294	Draw Plus 1.0 289.
Micro Logic ... NCP	
2968	Tornado 1.8 55.
Microlytics ... NCP	
2731	GOfier 2.0 (new version) 45.
Microsoft ... NCP	
2860	Learning DOS 2.0 35.
2899	Windows 286 2.1 69.
2904	Works 2.0 99.
2900	Windows 386 2.1 129.
2901	Word 5.0 209.
6195	Word for Windows 329.
2856	Excel 2.1 (req. 80286/80386) call
6133	Excel for OS/2 1.0 339.
5188	Quick Pascal 1.0 69.
2894	QuickBASIC 4.5 69.
2895	QuickC 2.0 69.
2853	BC Compiler 5.1 299.
Multisoft ... NCP	
4925	PC-Kwik Power Pak 1.5 79.

New England Software ... NCP	
4337	GB-Stat 1.5 \$159.
Nolo Press ... NCP	
2982	WillMaker 3.0 35.
Norton-Lambert ... NCP	
4928	Close-Up Customer 3.0 135.
4929	Close-Up Support 3.0 165.
5420	Close-Up Lan (8 user) 529.
Paperback Software ... NCP	
6358	VP-Planner 3D 1.0 169.
PC Globe ... NCP	
5902	PC Globe 3.0 39.
5900	PC USA 1.0 39.
Personics ... NCP	
3126	SeeMORE 2.0 54.
4328	Look & Link 1.1 59.
Peter Norton ... NCP	
3152	Norton Commander 3.0 89.
3146	Advanced Utilities 4.5 89.
6397	The Norton Backup 1.0 89.
Precision Software ... NCP	
6600	Superbase 4 for Windows 459.



Quarterdeck ... NCP
☐ **QRAM 1.0**—Manage your memory to it's fullest with QRAM. If you have an EMS 4.0 or EEMS board, QRAM can use it to free up more memory within the 0-640k area. \$49.



Norton-Lambert ... NCP
 Award-winning Close-Up connects two PCs via modem, linking screens & keyboards. Ideal for remote support & training.
☐ **Close-Up Customer/Terminal 3.0** \$135.
☐ **Close-Up Support/ACS 3.0** 165.

Samna ... NCP	
5799	Ami Professional 1.0 319.
Softlogic Solutions ... NCP	
3546	Disk Optimizer 4.05 45.
3542	Software Carousel 3.01 55.
Softview ... NCP	
3474	MacInTax for Windows (1989 taxes) 65.
Software Publishing ... NCP	
6289	Draw Partner 1.0 59.
3499	PFS:First Publisher 2.1 89.
3478	PFS:First Choice 3.02 105.
3496	Professional Write 2.12 149.
3493	Professional File 2.01 199.
3482	Harvard Graphics 2.13 339.
Symantec ... NCP	
3427	Q&A Write 1.01 139.
3425	Q&A 3.0 229.
3431	Timeline 3.0 399.
Systems Compatibility ... NCP	
6568	Word Exchange 4.0 55.
6564	Software Bridge 4.1 79.

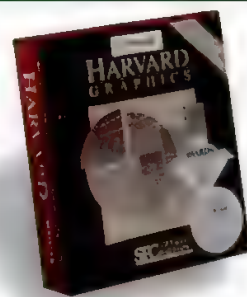


ButtonWare ... NCP
☒ **PC-File 5.0**—The most friendly, comprehensive database available. It includes letter-writing with mail merge, business graphing, and a powerful report writer. It also works directly on dBase files \$75.

Quarterdeck ... NCP	
3221	Expanded Memory Mgr. 386 5.0 59.
3220	DESQView 2.26 79.
4586	DESQView 386 129.
6400	Manifest 1.0 39.
6422	QRAM 1.0 49.
Reality Technologies ... NCP	
6572	WealthBuilder 1.1 145.
Reference Software ... NCP	
4396	Grammatik IV 1.0 52.
Revolution Software ... NCP	
4480	VGA Dimmer 2.01 (screen saver) 19.
RightSoft ... NCP	
4155	RightWriter 3.1 54.

1-800/243-8088

MMC PC Connection 710M
 6 Mill Street
 Marlow, NH 03456
 SALES 603/446-7721 FAX 603/446-7791



Software Publishing ... NCP
☐ **Harvard Graphics 2.13**—Be "free and easy" with the industry's best-selling presentation graphics package. Now includes Draw Partner drawing accessory FREE (normally \$149 List). Graphically the best choice.... \$339.

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Timeslips ... NCP

□ *Timeslips III 3.4*—Track every minute's efforts, then print the invoice and log the receivable all from the convenience of Timeslips III. Menu-driven and memory resident, this is a must for your service business. \$169.

- 2987 **Timeslips ... NCP**
□ *Timeslips III 3.4* 169.
- 6253 **Timeworks ... NCP**
□ *Publish-It! 1.1* 115.
- TOPS ... NCP**
3726 □ *TOPS Network Bundle 3.0* 159.
- 3720 *Flashcard 2.1 (AppleTalk network card; 1 year warranty)* 179.
- Traveling Software ... NCP**
4190 *Battery Watch 2.0 (3 1/2" only)* 35.
- 5179 □ *LapLink III 3.0* 85.
- True BASIC ... NCP**
3561 □ *True BASIC 2.1* 52.
- Vericomp ... NCP**
3765 □ *SoftBytes 2.0* 35.
- WordPerfect Corp. ... NCP**
3799 □ *WordPerfect Library 2.0* 75.
- 3804 □ *WordPerfect 5.1* 265.
- WordStar USA ... NCP**
2825 □ *WordStar Prof. Release 5.5* 229.
- 5000 □ *Upgrade to Release 5.5* 89.



Reality Technologies ... NCP

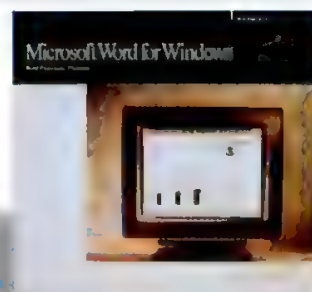
□ *WealthBuilder by Money Magazine 1.1*—Save & invest wisely. Set financial goals & achieve them. Plan for retirement, a child's education, a home. Optimize your portfolio & track all of your investments \$145.

Xerox ... NCP

- 3812 □ *Ventura Publisher 2.0* \$529.
- 6505 □ *Formbase 1.0* 319.
- XTREE ... NCP**
6161 □ *XTreePro Gold 1.3* 75.
- XYQUEST ... NCP**
4393 □ *XyWrite III Plus 3.55* 229.

RECREATIONAL/EDUCATIONAL

- Broderbund ... CP**
1417 □ *Where/Europe Carmen Sandiego?* 32.
- 5701 □ *Where/Time Carmen Sandiego?* ... 32.
- Electronic Arts ... NCP**
6436 □ *Hunt for Red October* 35.
- 4659 □ *Chessmaster 2100 (CP)* 35.
- 5804 □ *Deluxe Paint II (Enhanced)* 89.
- Microprose ... CP**
4454 □ *F-19 Stealth Fighter* 39.
- 5823 □ *Red Storm Rising* 39.
- Microsoft ... NCP**
2858 □ *Flight Simulator 4.0* 39.



Microsoft ... NCP

□ *Word for Windows*—Combines the power of Word for the PC with ease of use and WYSI-WYG accuracy of Microsoft Windows. Integrate graphics and data from Windows applications into your documents. \$329.

Parlor Software ... CP

- 3159 □ *Bridge Parlor 2.3* 49.
- Sierra On-Line ... CP**
6023 □ *Leisure Suit Larry III* 39.
- 5695 □ *Manhunter: San Francisco* 33.
- 4456 □ *Police Quest II* 39.
- 5106 □ *Space Quest III* 39.
- 6022 □ *Colonel's Bequest* 39.
- Spectrum Holobyte ... NCP**
5993 □ *Welltris (Tetris sequel)* 22.
- Spinnaker ... CP**
5580 □ *Sargon IV* 32.
- Stone & Assoc. ... NCP**
3435 □ *My Letters, Numbers, Words (2 to 6)* 22.
- 3438 □ *1st Math (ages 5 to 8)* 22.
- 3439 □ *2nd Math (ages 7 to 16)* 27.
- 5231 □ *Phonics Plus* 22.
- Sublogic ... NCP**
6190 □ *Air Transport Pilot* 33.
- True BASIC, Inc. ... NCP**
□ *Kameny/Kurtz Math Series: 10 titles* each 45.



Intel ... 5 years

Connection CoProcessor—Award winning fax-modem includes a free copy of Fax-it software from Intel. Send and receive information in the background from within many popular applications. New low price \$529.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

- AST Research ... 2 years**
1299 *SixPakPlus 384k C/S/P* 189.
- 4107 *RAMPage Plus 286 512k* 419.
- Brother International ... 1 year**
5787 *HL-8e Laser Printer* 1799.
- 5788 *HL-8Ps PostScript Laser Printer* . 2949.
- Compucable ... 2 years**
1604 *2-Position switch box* 25.
- 1605 *3-Position switch box* 35.
- Corvus ... 1 year**
6184 *ReadyNet Starter Kit* 319.
- 6183 *ReadyNet Add-On Kit* 165.
- Cuesta ... 1 year**
1608 *Datasaver 400 Watt (power backup)* 429.
- Curtis ... lifetime**
1690 *Diamond Plus SP-1 +* 41.
- 1694 *Emerald SP-2* 36.
- 1707 *Ruby SPF-2 (6 outlets)* 55.
- 1708 *Ruby-Plus SPF-2 Plus* 65.
- Diconix ... 1 year**
5655 *150 Plus Printer (Parallel)* 359.
- Epson ... 1 year**
We are an authorized Epson Service Center.
1906 *FX-850 (80 col., 264 cps, 9 pin)* . . 369.
- 1904 *FX-1050 (136 col., 264 cps, 9 pin)* . 479.
- 5183 *LQ-510 (80 col., 180 cps, 24 pin)* . . 349.
- 1930 *LQ-850 (80 col., 264 cps, 24 pin)* . 519.
- 1917 *LQ-1050 (136 col., 264 cps, 24 pin)* 725.
- 4116 *LQ-2550 (136 col., 333 cps, 24 pin)* 989.
- 5184 *LX-810 (80 col., 180 cps, 9 pin)* . . 199.
- 1052 *Printer-to-IBM cable (6 feet)* 15.
- 5th Generation ... 1 year**
3952 *Logical Connection 512k* 529.
- Hayes ... 2 years**
2307 *Smartmodem 2400* 349.
- 2308 *Smartmodem 2400B (w/Smartcom II)* 249.

to make the best of both.



Intel ... 5 years
2400EX MNP Modem—The newest member of Intel's modem family. MNP/Level 5 provides error-correction for reliable communications, as well as data compression for faster data throughput \$229.

- Hercules ... 2 years**
 2318 Graphics Card Plus 189.
Hewlett-Packard ... 1 year
 6583 Laserjet II (w/toner) 1739.
 6582 Laserjet IIP (w/toner) 1039.
 6581 Deskjet Plus (w/link cartridge) 719.
Intel ... 5 years
 4696 2400B Internal Modem 159.
 2352 2400B Internal Modem 2 (for PS/2) 249.
 5119 2400 Baud External Modem 179.
 6420 2400EX MNP Modem 229.
 2346 Inboard 386/PC w/1 Meg (w/free Arm) 579.
 4266 Above Board Plus 512k 419.
 4267 Above Board Plus I/O 512k 449.
 5336 Above Board Plus 8 2 Meg 599.
 5342 Above Board Plus 8 I/O 2 Meg 629.
 4272 Above Board 2 Plus 512k 469.
 5396 Above Board MC 320k 359.
 4275 Connection CoProcessor (w/Fax-it) 529.
 4857 Visual Edge (graphics enhancement for the HP LaserJet II) 449.
MATH COPROCESSORS
 2370 80287-8 (for 8 MHz 80286 CPU's) . 199.
 2369 80287-10 (for PS/2 Models 50 & 60) 229.
 4750 80387SX (for 80386SX CPU's) . . . 309.
 2371 80387 (for 16 MHz 80386 CPU's) . . 349.
 2372 80387-20 (for 20 MHz 80386 CPU's) 399.
Kensington Microware ... 1 year
 2582 Masterpiece Plus 109.
 5697 Expert Mouse (Trackball for PS/2) . 115.
Keytronic ... 3 years
 4518 101 Plus Keyboard 99.
Kraft ... 5 years
 5801 New Game Adapter (2 game ports). 27.
 5800 3 button Thunder Joystick 29.
 5802 Trackball 69.
Logitech ... limited lifetime
 5464 Series 2 Mouse (C9 for PS/2's) 69.
 5151 HiREZ Mouse (C9) 85.
 6029 Trackman (Trackball) serial 85. bus 89.
 4297 ScanMan Plus (hand scanner) . . . 185.
Micron Technology ... 2 years
 6005 Ascend 4 Meg Bnd. for Compaq 386 699.
 6013 Beyond Mem. Bnd. for Model 50 (512k) 359.

- Microsoft ... lifetime**
 2897 Mouse with Paintbrush \$109.
 2898 Mouse with Windows 286 2.1 139.
MicroSpeed ... 1 year
 6007 PC-TRAC Trackball serial 75. bus 85.
 6010 FastTRAP 3D Trackball serial 99. bus 109.
Mouse Systems ... lifetime
 5845 White Mouse (bus or serial) 69.
 5997 Trackball (1 yr. wrnty.) serial 75. bus 85.
 4306 PC Mouse II w/PC Paint+ 89.
NEC ... 2 years
 4799 Multisync 2A (VGA Monitor) 499.
 5085 Multisync 3D Monitor 689.
Orchid Technologies ... 4 years
 4690 ProDesigner VGA (800 x 600) 249.
PC Power & Cooling Sys. ... 1 year
REPLACEMENT POWER SUPPLIES
 3202 Turbo Cool 150 (25° - 40° cooler) 129.
 3200 Silencer 150 (84% noise reduction) 115.



Hilgraeve ... NCP
HyperACCESS/5 1.0—Blasts data through your modem faster than any other program. Potent, agile, civilized. An automation breakthrough ... it learns your work! Contains versions for DOS and OS/2. \$115.

- Practical Peripherals ... 5 years**
 3101 1200 Baud Internal Modem 69.
 3100 1200 Baud External Modem (mini) . 77.
 3103 2400 Baud Internal Modem 139.
 3102 2400 Baud External Modem 179.
 5286 2400 Baud Int. MNP Modem (Lex. 5) 175.
 5285 2400 Baud Ext. MNP Modem (Lex. 5) 209.
 4542 2400 Baud Internal Modem for PS/2. 229.
Safe Power Systems ... 2 years
 4561 Safe 250W (standby power bkup) 249.
 4562 Safe 425W (standby power bkup) 369.
SOTA Technology ... 2 years
 5111 SOTA 286i-12 (12 MHz accelerator) 269.
 5402 SOTA 386i-16 (16 MHz accelerator) 389.
Targus ... lifetime
 4899 Nylon Laptop carrying case 55.
 6037 Premier leather carrying case 199.

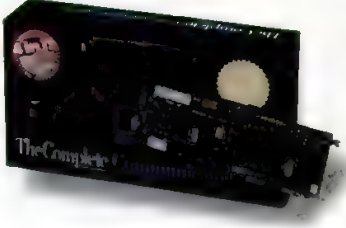
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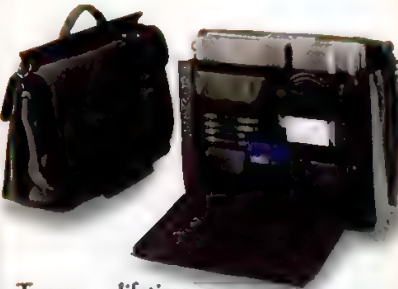


TheComplete PC ... 2 years
TheComplete Communicator—It's a 9600 bps fax. It's a 2400 bps modem. It's a sophisticated voice messaging and processing system. It's a scanner port. It's TheComplete solution! \$559.

- TheComplete PC ... 2 years**
 5598 TheComplete Half Pg. Scanner 400 189.
 5140 TheComplete Page Scanner 549.
 4887 TheComplete Fax 9600 429.
 5828 TheComplete Communicator 559.
Toshiba ... 1 year
 3684 T1000 Laptop (80C88, 6.4 lbs.) . . . 669.
 6332 T1000SE Notebook Laptop (5.9 lbs.) 1269.
 4958 T1600 Laptop (12 MHz, 20 Meg) . 3249.
Tripp Lite ... 2 years
 6201 Isobar 8 (8 outlets, 12 ft. cord) 69.
 6019 LS 600 Line Stabilizer 85.
 6018 LC 1200 Line Conditioner 159.
Video 7 ... 7 years
 5883 1024i VGA (includes 512k) 289.
 4931 VRAM VGA 512k 449.

DRIVES

- DTC ... 1 year**
 6248 AT Floppy/Hard Drive Controller . 129.



Targus ... lifetime
Premier Leather Carrying Case—Establishes a new standard of quality for business related luggage. This dual purpose case combines a luxurious, feature rich, leather briefcase together with a functional laptop carrying case \$199.

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IOmega ... 1 year

5116	Bernoulli II Single 44 Meg Internal	\$995.
5117	Bernoulli II Dual 44 Meg External	1969.
5113	44 Meg Cartridge Tripak (5 1/4")	249.
2499	PC2 Card (controller required)	169.

Mountain Computer ... 1 year

2917	40-60 Meg Internal Tape Drive	379.
5502	83-152M Ext. Tape Drive	759.
5500	83-152M Int. Tape Drive	629.
6153	DC2120 Cartridge (5 pack)	135.
5190	DC2000 Pre-formatted Cartridges ea.	35.

Pacific Rim ... 1 year

5010	1.2 Meg External (for PS/2's)	215.
6602	1.44 External (for PC/XT/AT)	239.

Plus Development ... 2 years

3105	Hardcard 20 Meg (49 ms)	529.
3106	Hardcard 40 Meg (28 ms)	599.
6424	Hardcard II 80 Meg (19 ms)	699.

Seagate ... 1 year

FREE PCTV® Hard Drive Installation
Tape with purchase of 20, 30 or 40 Meg
Seagate drive for the IBM PC (not for
AT), Beta or VHS.

2285	20 Meg Internal Hard Drive ST225 (w/controller and cables, 65 ms)	275.
2286	30 Meg Internal Hard Drive ST238 (w/controller and cables, 65 ms)	289.

Cables ... lifetime

1019	Smartmodem-to-AT cable (10 feet)	\$15.
5511	Right Angle Printer cable (6 feet)	15.
1050	Parallel Printer cable (15 feet)	19.

DISKS

All disks have a lifetime warranty.

5 1/4" DS/DD Disks (360k)

3291	Sony (10 disks per box)	12.
2789	Maxell MD2-D (10 disks per box)	13.



XTREE ... NCP

☐ **XTreePro Gold 1.3**—A treasure of advanced disk management features—Directory Tree Display, Application Menus, Archive Management, Autoview & Enhanced View. Single keystroke commands for all operations. \$75.



Practical Peripherals ... 5 years

2400SA MNP—Fully supports error-free MNP Level 5 data transmission, giving you more confidence in your communications. Also supports Hayes compatible 2400 bps standard operation. \$209.



Intel ... 5 years

Inboard 386/PC—Brings advanced computing power to your PC/XT system. Includes 16Mhz 80386 processor and 1Mb RAM. Flexible 32-bit memory expansion options are also available. \$579.

5 1/4" DS/HD Disks (1.2 Meg)

3292	Sony (10 disks per box)	19.
2790	Maxell MD2-HD (10 disks per box)	19.
	3 1/2" DS/DD Diskettes (720k)	
3297	Sony (10 disks per box)	14.
2792	Maxell (10 disks per box)	15.
	3 1/2" DS/HD Diskettes (1.44 Meg)	
3298	Sony (10 disks per box)	29.
2793	Maxell (10 disks per box)	29.

MEMORY

3248	256k DRAMs (120 nanosecond)	call
4366	1 Meg x 9 SIMMs (100 nanosecond)	call
5510	1 Meg x 9 SIMMs (80 nanosecond)	call
5746	1 Meg Chips (80 nanosecond)	call

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- No sales tax.
- All U.S. shipments insured; no additional charge.
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- Upon receipt and approval, personal and company checks now clear the same day for immediate shipment of your order.
- COD max. \$1000. Cash, cashier's check, or money order.
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- To order, call us Monday through Friday 9:00 AM to 1:00 AM, or Saturday 9:00 AM to 5:30 PM. You can call our business offices at 603/446-3383 Monday through Friday 9:00 AM to 5:30 PM.



WordPerfect Corp. ... NCP

☐ **WordPerfect 5.1**—Mix both text and graphics with this "high-end" word processor/publisher. Multiple new features including "hot links" to 1-2-3, Excel, and PlanPerfect along with networking—all built in. . . . \$265.

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Note: Accounts on net terms pay actual shipping.

Continental US:

- For heavy hardware items such as printers, monitors, Bernoulli Boxes, etc. pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add \$3 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.

Hawaii:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add \$3 per order.

Alaska and outside Continental US:

- Call 603/446-3383 for information.

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Checkfree

6360	CheckFree Xpress	25.
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CompuServe

1676	CompuServe Information Service	24.
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PC Cultivation.

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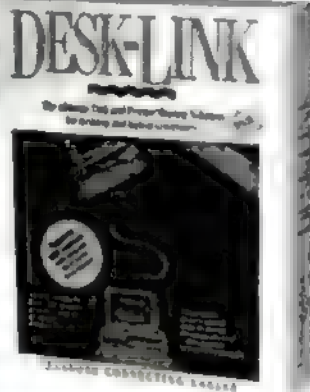
EDITOR'S CHOICE

DeskLink, Version 2.0
Traveling Software Inc.,
18702 N. Creek Pkwy.,
Bothell, WA 98011;
(800) 662-2652, (206)
483-8088.

List Price: \$169.95 for
two workstations
(includes universal
serial cable with 25 feet
of RJ11 phone wire).

Requires: DOS 3.0 or later, one serial port on
each workstation. Expanded memory
recommended.

In Short: *DeskLink* combines simplicity and
performance in an affordable package. It installs
easily and works invisibly, and it handles the
basics of disk- and printer-sharing well. Its easy-
to-use chat facility is a good, simple substitute for
true electronic mail.



CIRCLE 548 ON READER SERVICE CARD

100K of the DESK program into expanded memory, if you have it, which reduces *DeskLink*'s RAM appetite to a much more manageable level.

You can transfer files in two different ways. Since the remote workstation's drives are simply added to your own, you can copy files to them using DOS commands and utilities. But *DeskLink* also comes with a Disk Manager program, similar in appearance to *LapLink*'s familiar and easy-to-use dual-window display, which includes just about all the file management features you need, including a tree utility that shows subdirectories and files. Though *DeskLink* is limited in its overall performance by its lack of a parallel-connection option, its serial throughput was the best among all the packages, thanks to its ability to operate at 115,200 bits per second.

DeskLink also performs well in printer sharing. From either workstation, you can use the current local printer or any of the three printers that DOS lets you attach to the remote computer (serial printers must be redirected to a parallel device through the DOS Mode command in order to be shared). You can specify which printer you're using from the pop-up menu.

When you use a remote printer, the remote workstation holds your print jobs in a disk-based buffer until the printer can accept them. The menu lists the number of characters currently in the buffer, but otherwise you have little management control; you can empty the buffer (releasing some memory), but you can't delete or reprioritize individual print jobs.

DeskLink does not have true electronic mail, but pressing a hotkey brings up the handy chat feature, which is a good enough substitute for many purposes. You can type a message up to 60 characters long; pressing Enter relays your message to the other PC immediately, alerting the person at the other machine with a beep. The Esc key clears the chat box from the screen and returns the remote user to normal operations. If this causes a problem, you can disable the chat feature.

DeskLink's designers didn't include any security features, no doubt thinking them unnecessary in a product limited to two workstations. In many installations this won't matter, but if security is a concern to you, you'll have to turn to a competing package. *DeskLink* does not support NetBIOS, but the folks at Traveling Software have worked to ensure that it is compatible with more-powerful LAN software such as Novell's *NetWare*—which lets you use *DeskLink* to connect an extra workstation cheaply, through a serial link to a *NetWare*-equipped client machine. The attached PC sees the client's network drives as its own virtual drives.

DeskLink is a basic solution, lacking many of the features network users take for granted, and permanently limited to only two workstations. But for the simple tasks of transferring files, sharing printers, and sending quick messages, its simplicity and good design make it a very practical choice for the two-station LAN.

LANLink 5X

by Patricia A. McGovern

Most of the zero-slot LANs we review here are designed for two or three users at most. *LANLink 5X*, from The Software Link, is an exception, supporting up to 16 users over both serial and parallel connections. The parallel connections can be up to 500 feet in length with a special cable. *LANLink 5X* boasts a unique architecture and advanced features, and its sophistication is reflected in its high cost: a starter kit that supports two users is priced at \$395, with support for additional users costing \$100 each, and this does not include cables.

The *LANLink 5X* software comes in two parts: the server software, which lets you share a workstation's disks and print-

ers with the network, and the satellite software, which lets you use these shared resources. Under DOS, the server must be dedicated to the task; that server can support up to 16 satellite PCs in a star configuration, making use of both parallel and serial ports.

To take advantage of *LANLink*'s full potential, however, you run it as a task under *PC-MOS/386*. The Software Link's DOS-compatible multitasking operating system for 386 machines, or under *MultiLink*, a multitasking shell that runs on top of DOS and works on 286 machines. These let you use *LANLink 5X* without a dedicated server (technically, the server software runs in one partition and the satellite software in another). They also add print spooling and enhanced security features that are otherwise not included. The *LANLink 5X* starter kit comes with *PC-MOS* or *MultiLink* at your option, so you can share the resources of both stations in a two-station network when the software is right out of the box.

TEST YOUR DOS KNOWLEDGE

As you might imagine, installing *LANLink 5X* puts your knowledge of DOS, command line entries, and memory management to the test. But first you must wade through the treacherous waters of the documentation. There are two separate installation guides, one for *PC-MOS* and one for *MultiLink*, but neither includes instructions for loading the software under DOS. The company is understandably very inter-



FACT FILE

**LANLink 5X,
Version 2.1**

The Software Link,
3577 Parkway Ln.,
Norcross, GA 30092;
(800) 451-LINK, (404)
448-5465.

List Price: Starter Kit
for two workstations

(includes server and satellite software, plus a
single-user version of *PC-MOS*), \$395. Additional
workstations, \$100 each; additional servers,
\$150 each. 50-foot serial cable, \$50; 25-foot
parallel cable, \$50; 50-foot parallel cable, \$75.

Requires: DOS 2.0 or later, one serial or parallel
port on each workstation, one serial or parallel
port per workstation on server. Hard disk on
server recommended.

In Short: *LANLink 5X* is another breed of zero-
slot LAN, supporting up to 16 users in a
client/server configuration, and relying on a
multitasking operating system (*PC-MOS*) for print
spooling. Though powerful and expandable, its
flexibility comes at the cost of complexity.

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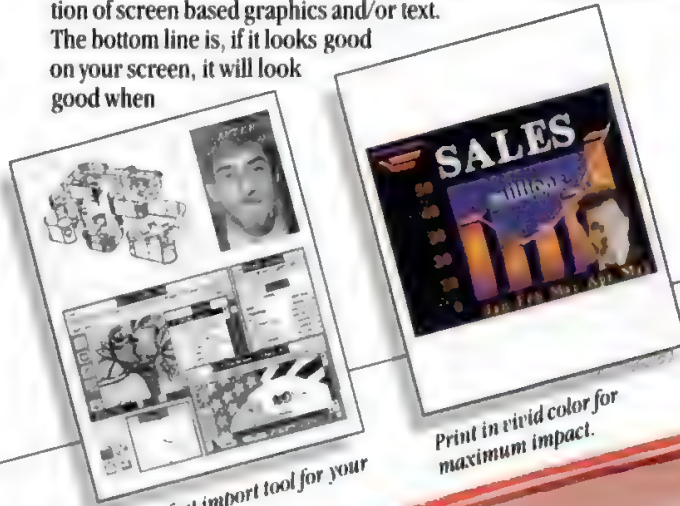
Adobe Systems, Acer, Alps, AMT, Anadex, Apple, AST, AT&T, Brother, C. Roh, CalComp, Canon, Centronics, CIE, Dataproducts, DEC, Diablo, Diconix, Epson, Genicom, Hewlett Packard, IBM, IDS, Infoscrite, JDL, Kyocera, Laser Connection, Mannesmann Tally, NEC, Newbury Data, Oasis, Okidata, Panasonic, Printronix, QMS, Quadram, Qume, Seikosha, Sharp, Star Micronics, Tandy, Tektronics, TI, Toshiba, Transtar, Unisys, Xerox, Wang

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Memory resident program takes as little as 32K. All manufacturer's names or product names are registered trademarks of their respective manufacturer. Screen images courtesy of AT&T and Facet, Inc. **CIRCLE 386 ON READER SERVICE CARD**



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CONNECTIVITY

ZERO-SLOT LANS

ested in encouraging users to take advantage of its operating system, but failing to acknowledge the existence of DOS is not the best way to do this.

After you copy the appropriate software to the server's hard disk, you install the SERVER.SYS device driver in CONFIG.SYS with appropriate options (which define the port, the baud rate, and the drives and printers that are to be shared with the network). You must allow 32K of RAM on the server for each satellite station connected to it. Then you run the

LANLink 5X is uniquely flexible among the products in this review. Yet if you need something this big, you should consider a low-cost media-shared network.

LANSERVE program, following it with the correct options to customize the server's accessibility and performance, such as flow control, password retry, and time-out period.

On the satellite PC, you must copy the program files to the hard disk or the boot diskette and then modify CONFIG.SYS to include the satellite device driver, again with the appropriate options for ports, baud rate, and drives and printers. Unfortunately, though these options look the same as the server options, they don't have exactly the same meaning, so this part is fairly confusing.

FEATURES TO SPARE

Once you've got it installed and running, LANLink 5X works reliably. You must use DOS commands to control network devices; for example, typing LAN LPTON 1 lets you direct your printer output to the printer on the first server. An indicator blinks in the upper-right corner of your screen when you're accessing a server's disk.

To help you manage the network, LAN-

Link 5X puts its performance and configuration data at your fingertips. At the server, you can view the drives and printers available, as well as the port number and baud rate of each attached satellite. You can even see the number of data packets successfully transmitted, the number of transmission errors across the network, the number of file control blocks currently accessed by the satellite, and the number of file handles open.

LANLink 5X is notable for its modem and CD-ROM support. No special hardware or software is required to use modems attached to any server on the network. And you can attach CD-ROM drives to the network with a special driver and a little help from The Software Link's technical staff. The program supports record and file locking through the DOS Share command, and at the time of this review The Software Link was working on a release with NetBIOS support.

LANLink 5X does not include a print spooler of its own, but a disk-based print spooler comes with PC-MOS, so you can cancel and reprioritize your jobs and switch printers if you run the software under that operating system. Another benefit of PC-MOS is a full-featured security system, which supports up to 26 levels of access, and lets you assign execute-only or read-only status to individual directories or PC-MOS partitions. Unfortunately, the program has no electronic mail; menu-based utilities and on-line help are also absent.

This package's performance is a mixed story. On the positive side, its parallel links were the fastest in our group. But although its serial transmissions whiz along at 115,200 bps, somehow that doesn't seem to translate into better throughput: LANLink 5X had the worst score of any of the packages on serial transmission. Clearly, if your distances aren't too great for parallel connections, this product can be speedy, but otherwise your network is likely to perform sluggishly.

LANLink 5X is uniquely flexible among the products in this review, being the only one that can be expanded to more than two or three stations. And on parallel connections, at least, it can be quite fast. Yet if you need something this big, you should consider a low-cost media-shared network instead, which will give you much better performance and expandability without much more cost.

LANtastic /Z

by Patricia A. McGovern

Artisoft has established an impressive track record, with low-end networking products of proven excellence. In *PC Magazine's* issue of March 28, 1989, LANtastic received our Editor's Choice. Now, Artisoft is marketing a zero-slot version called LANtastic /Z, for those with modest needs, who don't want the trouble or cost of interface cards.

This feature-packed \$199 package connects two computers over either serial or parallel links (both types of cables are included in the box). It supports NetBIOS, letting you share communications gateways and other devices over the network.

Aside from its lack of interface cards and its limited number of nodes, LANtastic /Z differs little from its larger, media-shared cousin. Both are notable for their small memory requirements (LANtastic /Z takes only 26K of RAM). Both let you establish access rights and customize your setup either from the command line or through pull-down menus. And both incorporate the same electronic mail system and offer the same capability of sharing CD-ROM drives.

Installing the LANtastic software is a simple process; you run the program on the distribution diskette, select Install from the menu, and the rest follows. You must make sure that your Files and Buffers specifications in CONFIG.SYS are high enough, but this is well covered in the program's excellent documentation.



FACT FILE

EDITOR'S CHOICE

LANtastic /Z,
Version 1.0
Artisoft Inc., 575
E. River Rd.,
Tucson, AZ
85704; (602)
293-6363.

List Price: \$199
for two workstations, (includes
25-foot serial cable and 18-foot parallel cable).

Requires: DOS 3.1, 3.3, or later; parallel or serial
port on each workstation. Hard disk recom-
mended

In Short: A good performer that supports either
parallel or serial connections, LANtastic /Z
manages to incorporate a full set of
features—including excellent printer control,
powerful e-mail, and good security—in under
40K of RAM. It can easily be upgraded to
Artisoft's media-shared LAN.

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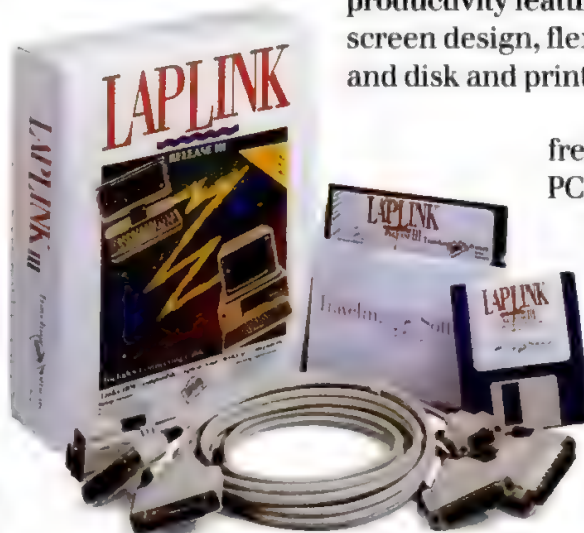
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A CHIP OFF THE OLD BLOCK

LANtastic /Z does an excellent job of printer sharing. Any PC with a shared printer attached must have a hard disk to hold queued print jobs. The menu-based control software (which can be run as a foreground program or loaded as a 5K memory-resident utility) lets you display the status of the print jobs in the queue, and you can cancel them or set their priority. The same utility lets you log on to remote workstations and their disks, and use the electronic mail system. Though easy to use, the software could be improved by the addition of

LANtastic /Z has a full-featured security system. But the wide-open approach is probably more in line with the way people use zero-slot LANs.

a small help system and by better error handling.

LANtastic /Z's full-fledged electronic mail package lets you read your mail and forward it to other users, and it includes a handy text editor for writing messages. The program also has a Net Send command that lets you send any file to another station; this can serve as a chat feature between two stations (the receiving station is notified by a beep and can quickly read the message).

Because it evolved from a larger network system, *LANtastic /Z* has a full-featured security system. Unfortunately, this slightly complicates the installation. Before anyone can use the network, you must set up accounts for each user, providing user names, optional passwords, and special privileges, and specifying the resources you want to make available to each account. This takes only a little longer to do than it does to read about, but the wide-open approach of *DeskLink* is probably more in line with the way most people use zero-slot LANs.

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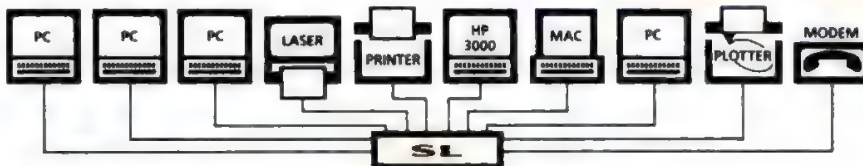
PC Magazine [July 1989, Page 263]:

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CONNECTIVITY
ZERO-SLOT LANS

Artisoft backs its product well. The cables and software come with a 90-day warranty, and the company provides a 30-day money-back guarantee against incompatibility. End users can obtain 30 days of free telephone or bulletin-board support, after which they can purchase a one-year extended support plan for \$50 (bulletin board) or \$100 (telephone). Support is free and unlimited to dealers.

LANtastic /Z takes a little more savvy to set up than some of its simpler competitors, but its high quality, good performance (especially over parallel connections), and low memory requirements amply make up for any extra work you may have to do. If you need real networking for two or three stations, this is the one to choose.

MasterLink

by Patricia A. McGovern

MasterLink is the smallest in a family of similar networking products from U.S. Marketing. For \$149.50, it lets you connect two computers over a serial cable, allowing them to access each others' shared drives and printers simultaneously. Like its larger cousin *ZeroNet* (which supports three to ten computers), *MasterLink* offers record and file locking and NetBIOS support at a low price. But its quirks may send you elsewhere.

The difficulties start with the documentation, which consists of separate manuals for *ZeroNet* and another product, *ZeroLAN*, plus a nine-page supplement describing the installation differences in

PC FACT FILE

MasterLink, Version 5.0
U.S. Marketing Inc.,
1608 17th Ave. South,
Nashville, TN 37212;
(615) 269-9071.
List Price: \$149.50 for
two workstations
(includes 14-foot serial
cable).
Requires: DOS 2.0 or later, serial port on each
workstation. Hard disk recommended.
In Short: *MasterLink* is affordable and functional,
but it doesn't have a print spooler or electronic
mail, and its design lacks the polish of some of its
competitors.



ZeroNet

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are with DOS commands, and altering
the AUTOEXEC.BAT and CON-
FIG.SYS files—easy enough if you under-
stand it but not something a computer nov-
ice should tackle. You then use a
configuration program (SETNET) to des-
ignate the drives and printers you wish to
share. The program uses a simple menu to
create the setup parameters, and it has a
handy help feature; though the keystrokes
aren't always intuitive, the average user
should have no problems getting through
the procedure.

MasterLink is a TSR that uses a reason-
able if not thrifty 75K of RAM. Unfortu-
nately, though you can disable it with the
SETNET Off command, it has no way of
unloading itself and freeing up the memory
it uses.

SHORTCOMINGS

Once you've installed and configured both
PCs, access to printers and drives is trans-
parent. There is no notification of connec-
tion at either end; both computers simply
appear to have grown new drives. But the
package's performance is relatively poor;
it ranked second from the bottom in our
tests.

MasterLink does have a decent security
system. You can protect any local drives
from access through the SETNET pro-
gram, and command line utilities allow
you to secure files and to lock and unlock
drives without going back through the

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- Built-in parallel port and two serial ports

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- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Built-in game port interface (requires cable, 48954)
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- 387SX math coprocessor socket
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- 101-key enhanced keyboard
- Monitor optional.

CompuAdd 212 Monitor And Hard Drive Options

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80MB (19ms)	64733 — \$1729	66527 — \$1829	64743 — \$2059

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- ROM shadowing into faster DRAM
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- Built-in parallel port and two serial ports
- Five available expansion slots
- 387 math coprocessor socket
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- 40MB hard drive
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- 16-bit VGA video adapter card
- 101-key enhanced keyboard
- New Spinnaker Eight-in-One integrated software
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CompuAdd 316 Monitor And Hard Drive Options

	MVGA	CVGA
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80MB (19ms)	64813 - \$2425	64818 - \$2525
110MB (19ms)	64814 - \$2625	64819 - \$2825
320MB (18ms)	64815 - \$3075	64820 - \$3275

CompuAdd 325 Monitor And Hard Drive Options

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- Built-in parallel printer port and two serial ports
- Built-in game port interface (requires cable, 48954)
- Three full-size 16-bit and two half-size 8-bit AT class expansion slots
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- Monographics monitor and adapter
- Panasonic® 1180 printer and cable
- CompuAdd MS-DOS v4.01 and GW-BASIC® software
- New Spinnaker Eight-in-One integrated software
- 101-key enhanced keyboard
- Computer paper and ten blank diskettes
- Color monitor optional.

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40MB (69ms)	64718 — \$1329	64723 — \$1469	64728 — \$1689	
Professional Starter Kit Monitor And Hard Drive Options				
	MGA	MVGA	CVGA	
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SETNET program. But this is offset by the fact that *MasterLink* offers no messaging or print-spooling features at all (if the printer is in use, your workstation gets a busy signal until the current job is finished). And if you want e-mail, you must purchase an additional package called *Zip-Mail* for \$119.

MasterLink works reliably, and its functionality and affordable price make it look attractive at first sight. But its crudities, especially in installation, and its lack of features outweigh these advantages.

Printer LAN

by Patricia A. McGovern

Printer LAN from Grapevine LAN Products (formerly Computer Pathways) is targeted at users of small networks who want to share resources without high cost or complexity. The \$295 package lets up to three computers share printers and peripherals via serial connections up to 50 feet in length (the program does not support parallel links).

As the name implies, *Printer LAN* is most adept at printer sharing. Configuration is easy, thanks to Grapevine's excellent manual and easy menu options; you simply designate which printer you want to use and that's all there is to it. A pop-up menu lets you change the printer (or switch to your local printer) while you're in the middle of an application.

Print jobs from the network can be queued up on any workstation as long as it



FACT FILE

Printer LAN,

Version 1.0

Grapevine LAN

Products Inc.,

15323 NE 90th

St., Redmond,

WA 98052; (206) 869-2707.

List Price: \$295 for three workstations

(includes two 25-foot RJ11-type serial cables with 9-pin and 25-pin connectors).

Requires: DOS 3.1 or later, one serial port per workstation. Hard disk for printer host recommended.

In Short: *Printer LAN* sports impressive print spooling and electronic mail, and it is easy to install and use for up to three workstations. But it's more expensive than its competitors and it doesn't support parallel connections.

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CONNECTIVITY

ZERO-SLOT LANS



EDITOR'S CHOICE

- DeskLink
- LANtastic/Z

Zero-slot LANs are an entry-level solution, so your decision to purchase one should be based on expandability as well as on features and price. The products in our review are generally simple to install and use, so support isn't a big issue. And they are quite compatible with most PCs and DOS applications, so that isn't much of a worry, either.

If you expect to grow in the future, *LANtastic/Z* is the best place to start. Sporting the same software as Artisoft's excellent low-cost media-shared LAN, it offers a full kit of features, including electronic mail and good security, at only \$199 for two users. It also performs well, thanks to its use of parallel ports, and uses only 26K of RAM. Best of all, when you are ready to expand to a full-scale LAN, you can do so simply by inserting network adapter cards, copying some software, and changing a few batch files. If you're serious about connectivity but don't yet have a budget to match your interest, you'll find *LANtastic/Z* a worthy investment in the future.

If your needs begin and end at two stations, however, check out Traveling Software's *DeskLink*. Though more basic in design than most of its competition, this \$169.95 program's simple disk- and printer-sharing features should satisfy the needs of most zero-slot LAN users, and its handy chat feature is an able substitute for true electronic mail. Installation takes seconds, and even DOS novices quickly understand its operation without coaching. Though it does not support parallel connections, *DeskLink* was the fastest of the serial LAN packages.

has a hard disk, regardless of whether the printer is attached to it. The *Printer LAN* software lets you view the queue, cancel your print jobs, or change their order from any workstation. Jobs are printed smoothly in the background, so you're not interrupted if another workstation is using your printer.

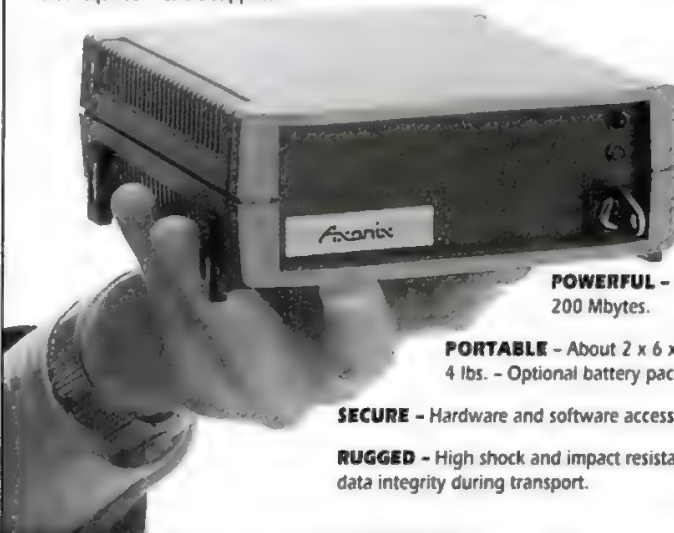
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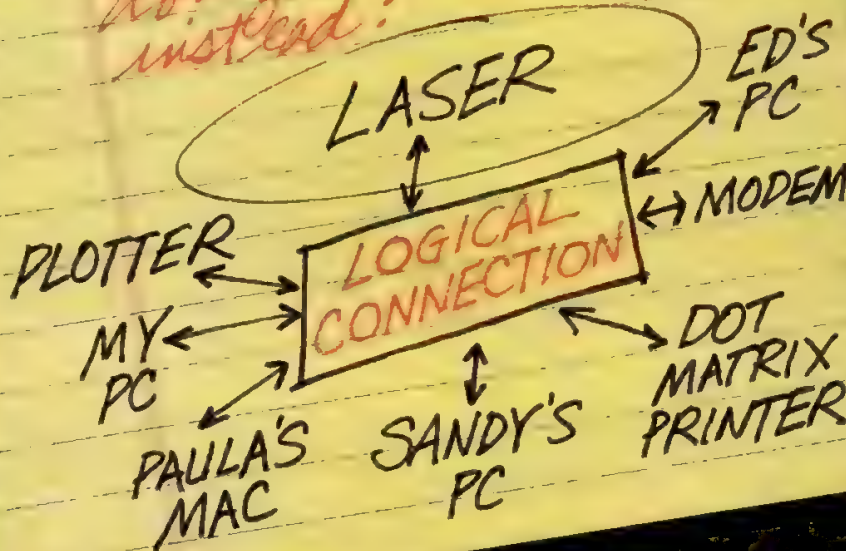
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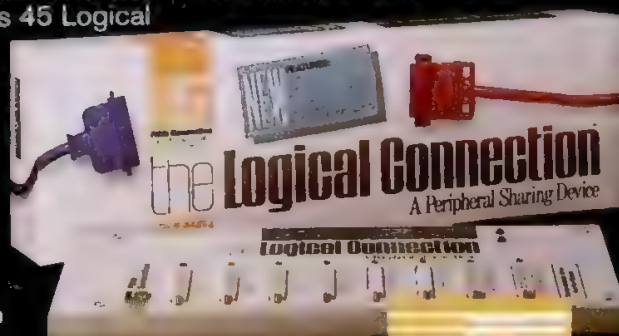
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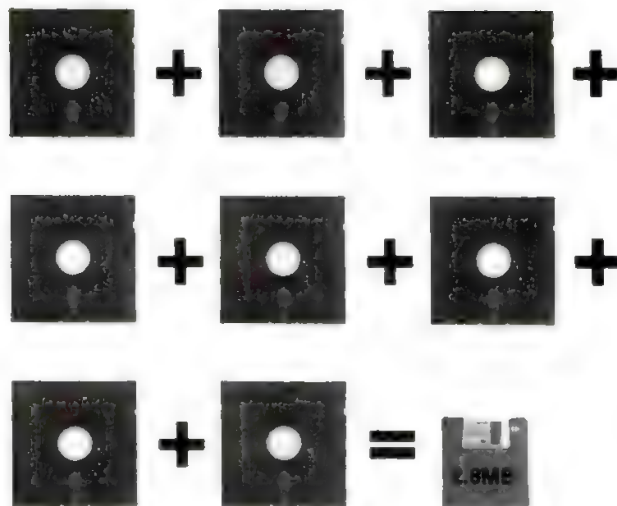
The program also offers remarkably full-featured electronic mail, which lets you attach binary or text files to messages for transfer to another workstation. When someone sends you a message, you're notified by a screen note and a beep; pressing the Alt key shows the message. You can edit, forward, file, and archive messages, as well as create standardized forms and mailing lists.

Security features are similarly thorough. The network control menu gives you the option of assigning a log-on password to ensure security for your station. You can also password-protect the drives and printers you are making available to the network; when a remote user attempts to access a secured drive, a box pops up on his screen for typing in the password. In addition, you can offer any combination of read, write, or create privileges on any directory to remote users.

In its full version, the memory-resident *Printer LAN* software takes 128K of RAM; with expanded memory, or by using a cut-down version that excludes some of its network features, you can trim this to about 64K a more practical amount. Grapevine provides 90 days of free telephone support to registered users.

Printer LAN offers good flexibility and security, and it does an excellent job of sharing printers. But its lack of support for parallel connections hurts its performance. ■

Kimberly Maxwell is a newspaper reporter who now makes computers her beat. She is a regular in the LAN Labs crew. **Patricia McGovern** is a system's analyst and small computer support specialist for a major systems integrator. **Carnot G. Milligan III** is a veteran of hundreds of network installations as a system support specialist for a regional systems integrator.



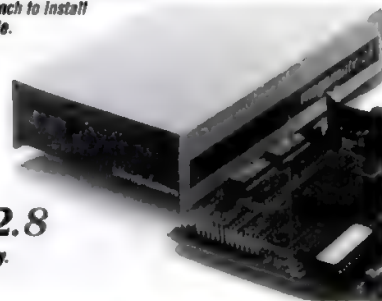
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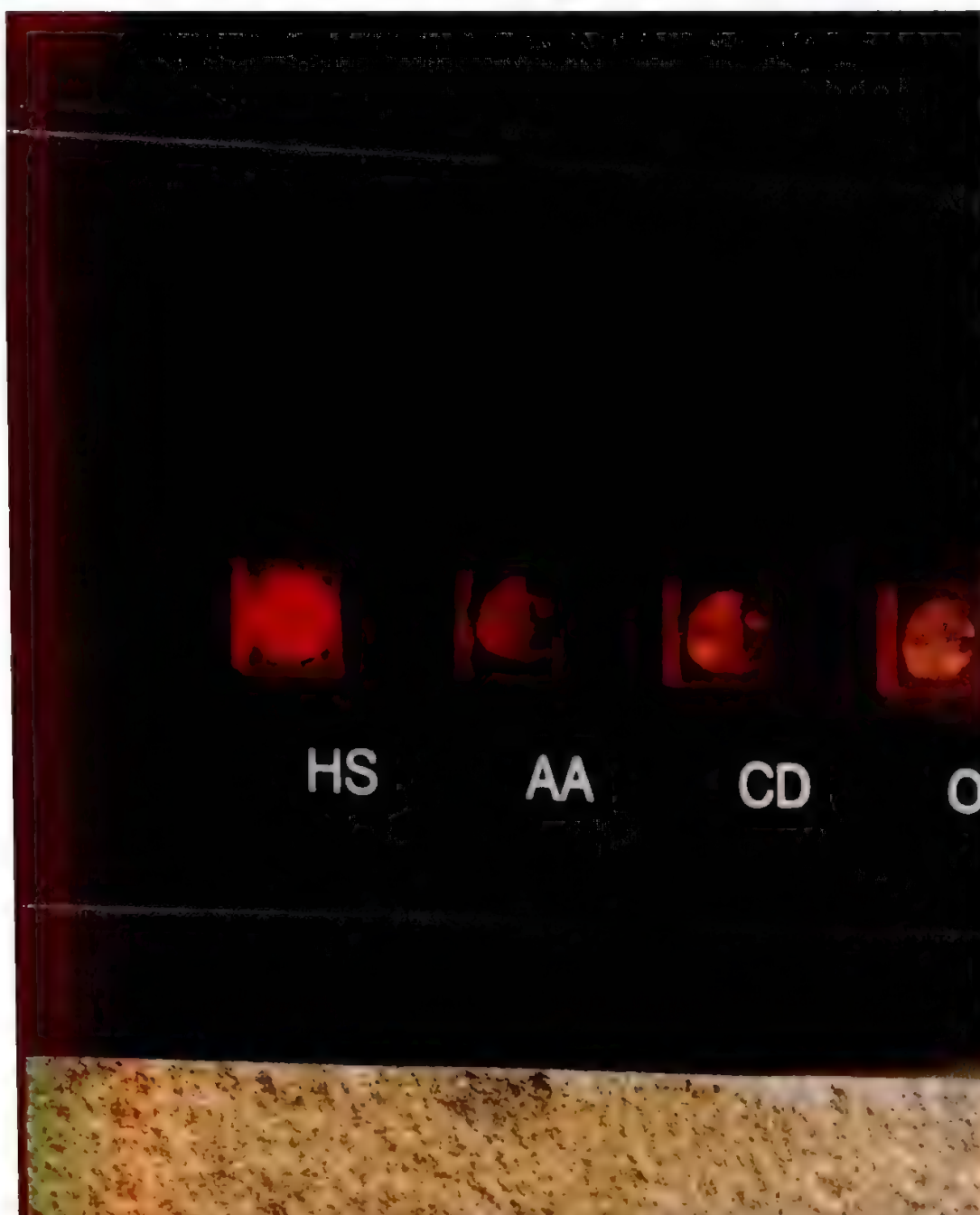
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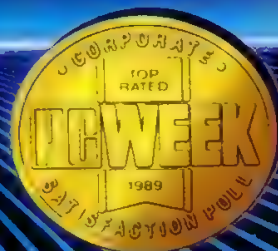
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DATA PROJECTORS

From Barroom to Boardroom

Data projectors featuring high-resolution capabilities take advantage of the magic of the big screen to produce the best-possible images from real-time desktop computer graphics.



by Alfred Poor

Some years ago, entertainment pundits proclaimed the end of movie theaters, reportedly doomed by the new home videotape market. What these experts failed to account for was the magic of the big screen—something that just cannot be reproduced on even the sharpest 35-inch display in your home entertainment center.

Many PC users may not be aware of it, but the same big screen performance is available for their personal computers.

HARDWARE

DATA PROJECTORS

Dozens of video projectors currently on the market let you project images 20 feet wide and wider.

One of the first projectors of this sort was a green monochrome device from Electrohome. It was the darling of many early computer shows, and its curved screen was a familiar sight in the seminar sessions. It was not particularly bright, however, and the curved screen required you to avoid sitting too far to the side if you wanted to see the image.

Video projectors have come some way since those early days. Now, most rely on three separate beams—red, green, and blue—focused on the screen to form a single full-color image. Many of these projectors are designed to handle standard composite video signals, such as those produced by broadcast television or a VCR, and you often find these three-eyed monsters screening football games at local watering holes.

Computer images have gone beyond composite video resolutions, however, and the projectors you find in bars are not capable of handling anything more complex than a CGA image. For most installations, this is hardly worth the hefty five-figure price tag that many of these systems carry.

DESIGNED FOR DATA

Fortunately, the video projector manufacturers have kept pace with the market and now offer a variety of models that can address the higher resolutions that have

become commonplace in today's PC arena. In order to distinguish these from the lower-resolution designs, they refer to them as *data projectors*.

Depending on the resolution they can display and the technology used in their construction, data projectors vary in price from under \$10,000 to over \$100,000. For this review, we invited vendors to submit one model with a list price of under \$15,000. The eight models we received from most of the major players do a good job of defining the marketplace.

Not all video projector manufacturers are represented here. Panasonic and Eiki declined to participate. In addition, Kodak and Sharp both have small projectors that use LCD technology to create an image. Both units are designed for composite video, however, and can produce only CGA-resolution images; the vendors declined to submit their machines for this review.

You may be surprised to find many similarities among the tested models. With one exception, they all use nearly identical cathode-ray tubes (CRTs) to project their images. All will mount on a table (or pedestal or floor mount), or hang from the ceiling. All are designed to be used with flat screens, though some can also use curved screens, which are less affected by ambient light.

And since all use the same three-beam design, each must be carefully set up and

focused in order to get the highest-quality image. None of these is strictly an end-user product; all installations are presumed to be professionally designed and set up. There is as much art as science involved in converging the three beams so that they precisely overlap at all points on the screen. In fact, our testing of these products demonstrated clearly that the skill of the technician installing the projector probably has as much effect (if not more) on the final image quality as any of the electrical or optical components involved.

As a result, one of your primary selection criteria for a unit such as this is the quality of service that accompanies it. You should probably spend at least as much time researching your local dealer options as you do investigating the manufacturers and models.

WHAT'S THE DIFFERENCE?

There are a number of differentiating features worth considering, however. Depending on your needs, these can make a big difference in your satisfaction with a data projector.

Some projectors can accept a variety of signals, while others accept only one or two. A few of the projectors actually take modular input circuits designed for different video or PC graphics signals. Others rely on a separate switcher or controller to accept and process the different types of signals before they pass them on to the projector. Within this category, some models come with the switcher/controller; other vendors offer it only as a separate option; in other cases still, you may have to turn to a third party, such as Extron Electronics, for a controller.

In many cases, you will not be able to hook up a monitor in addition to the data projector unless a controller is part of the system. The controller adds the ability to "pass-through" the signal to both a monitor and a projector. You can use a splitter cable in some cases, but then you might lose signal quality. This is more a problem with analog VGA signals than with the digital CGA and EGA signals.

Digital signals have their own problems, however; they can lose data over longer cable runs. This is particularly a problem with a ceiling-mounted projector, and a separate controller can help by converting the digital signal to an analog one that can run reliably over longer distances.

One of the biggest differences among

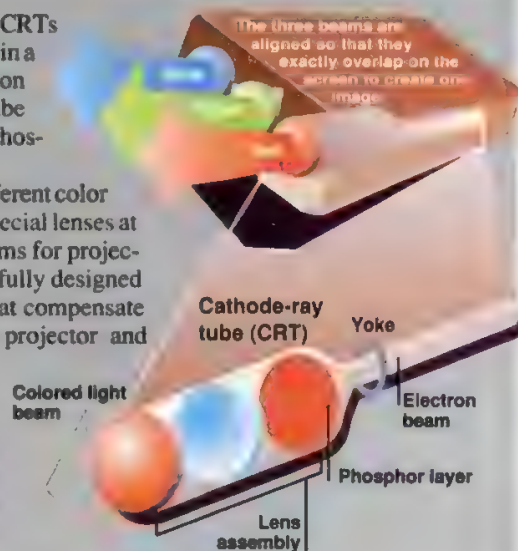
DATA PROJECTORS: How They Work

by Alfred Poor

Data projectors are built using three CRTs (cathode-ray tubes) like those used in a monochrome monitor. An electron gun and a deflection yoke in each tube play a beam of electrons across a phosphor-coated surface.

Each of the three CRTs uses different color phosphors: red, green, and blue. Special lenses at the front of the tubes focus the beams for projection onto the screen; these are carefully designed and built to permit adjustments that compensate for distance and angle between projector and screen.

Different projectors use different designs. Some use hybrid plastic and glass construction, while others are all glass. The three beams must be carefully aligned so that they converge precisely on the screen to create a single image.



HARDWARE

DATA PROJECTORS

the units is how the beam alignment is performed. Some projectors have potentiometers inside the case, and the installer must twiddle with these adjustments. Other projectors use digital convergence technology, and all the adjustments can be made by pressing buttons on a console. In many cases these buttons are available on a remote-control panel, either wired directly to the projector or communicating via infrared signals. Some digital designs also have on-screen prompting to guide you through the alignment process.

Projectors all feature the same basic set of convergence controls, which adjust the image size and shape. Some of the digital convergence designs also permit zone control for the individual beams. This means that you can "grab" a point on the screen for a given beam and drag it into the precise location for best overlap with the other two beams.

On the upside, this means you get excellent control over the convergence. On the downside, it can take even longer to set up a unit, and an installer might be tempted to try to compensate for less-than-optimal general settings by trying to fix the image with the zone controls.

A related issue concerns how the projectors handle different frequencies. Some systems are designed so that they are aligned for one frequency signal, converting others to match that. With others, you store two or three settings to cover different frequency ranges, and the controller extrapolates to cover those frequencies that fall between the settings. The most-sophisticated designs use digital convergence and store different settings for eight or more signals. The advantage of this technology is that you get more precise control over image quality for a variety of signals. The price that you pay is that it takes time to set and store each of these settings.

TAKES A LITTLE TIME

You might get the impression that the setup of these data projectors is not a simple task, and you would be right. We asked the vendors to send a technician to align the projectors for our tests; in some cases, they sent two people. In every instance, it took more than an hour for the technicians to get the convergence settings aligned. In a number of cases, we got the impression that they would have taken twice the 2-hour limit if we had given them the option.

Obviously, this shows that setting up is

not something you will want to do frequently. These are not the kinds of systems that you will want to wheel from room to room on a regular basis; it simply takes too long to align them to get an image of acceptable quality.

The data projector vendors are responding to this problem, however. The future for data projectors lies in self-contained rear-projection units. The military is already relying heavily on these designs, because the projectors are mounted in large cabinets that make it possible to move them around without having to reconverge the beams.

Another advantage to the rear-projection unit is that the image is less susceptible to ambient light, meaning you can keep the room lights brighter than with front projection onto a flat screen. Since these data projectors are about one-tenth as bright as the LCD panels reviewed in a companion article, front projection requires the viewing room to be much darker than would be acceptable with an overhead projector panel. Many users are taking advantage of rear-screen projection and building data projectors into the walls of training centers and boardrooms.

The future of video projectors lies closer to the LCD panels than you might expect. The Sharp and Kodak projectors are harbingers of things to come. As LCD technology improves, manufacturers will be able to put extremely bright lights behind color LCD layers and project high-resolution images in full color. The result will be VGA-resolution images (or better) that can be viewed by a roomful of people without dimming the lights. These products are at least three to five years off, according to industry sources.

For now, data projectors are the way to get the best-possible image

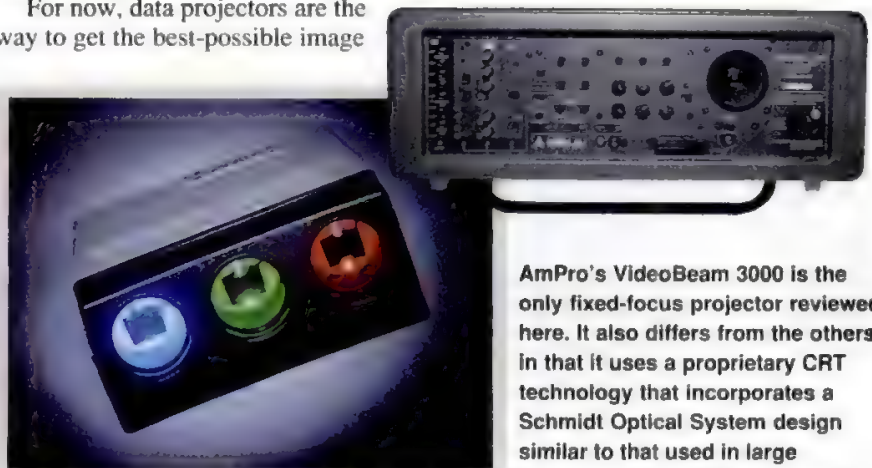
out of real-time desktop computer graphics. And it's not all that expensive: these systems can cost far less than some top-name-brand manufacturers' full-blown 33-MHz 386 PCs. Once you have picked the dealer and had your unit installed, you'll be ready to fire up your PC and put on a show that will make the most of all those great desktop presentation programs you've been dying to show off.

AMPRO CORP. VideoBeam 3000

The VideoBeam 3000 from AmPro Corp. is different from the other machines in this category in a number of distinct and significant ways. The list price of \$9,300 is not as unique, but it is likely to get your attention.

AmPro is the successor to Kloss Video where the VideoBeam was originally developed. One of the VideoBeam's distinguishing features is that it is the only fixed-focus projector in the group. This means that the projector is designed to display a specifically sized image that cannot be altered. One possible advantage of this feature is that the unit is easier to set up and align, since the CRTs are already focused. If you absolutely must relocate the projector frequently, then the VideoBeam may have an edge on the competition. However, you typically do not move these projectors around much.

The fixed-focus aspect of this projector meant that it was unable to create the standard seven-foot-wide image we used for testing. The company provided its closest unit—one that's designed for a seven-foot diagonal screen—which is equivalent to a screen about 5.5 feet wide.



AmPro's VideoBeam 3000 is the only fixed-focus projector reviewed here. It also differs from the others in that it uses a proprietary CRT technology that incorporates a Schmidt Optical System design similar to that used in large telescopes. (Inset: control panel.)

Big Deal?

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- 1.2 or 1.44MB diskette drive
- VGA output with 800x600 resolution
- VGA monochrome monitor
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DRIVE (VGA GAS PLASMA)

- Intel 80386SX-16 CPU
- VGA gas plasma display, 640x480 resolution with 16 shades
- External VGA monitor port
- 1MB of base RAM, expandable to 4MB with memory daughterboard
- AMI BIOS with ROM setup and diagnostics
- Expansion slots: 1 half-length slot available
- 1.44MB diskette drive (external 1.2MB drive connector built-in)
- 40MB, 25mS hard drive (IDE interface)
- 1 parallel and 2 serial ports
- 87-key keyboard (external keyboard connector port built-in)
- 65W power supply
- Carrying case
- Weight: approx. 15lbs.

DATA 386SX \$1095



- Intel 80386SX 16MHz CPU (Norton SI ver 4.0: 18)
- 1MB RAM standard, expandable to 8MB on motherboard
- 80387SX coprocessor socket
- Expansion slots: 6 16-bit and 2 8-bit
- 1.2 or 1.44MB diskette drive
- 200W power supply
- Monochrome card and monitor
- Options include hard disks from 20MB to 700MB, tape backup, modem, mouse, Wordperfect key caps, DOS, extra floppy, monitors, game card, coprocessor and tower case

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- 80387/Weitek socket
- EMS 4.0 driver
- Expansion slots: 5 16-bit and 2 8-bit slots
- 200W power supply
- 16-bit VGA adapter w/512K, 1024x768 resolution
- NEC Multisync 3D monitor
- Options include hard disks from 20MB to 700MB, tape backup, modem, mouse, Wordperfect key caps, DOS, extra floppy, monitors, game card, coprocessor and tower case
- 386-25 From \$2295 for mono system with 1MB

DATA-486 \$5345



- Intel 486-25, with 4MB of RAM expandable to 16MB on motherboard
- Super performance, Landmark Ver. 1.14 rating: 114MHz, Power Meter Ver. 1.5 rating: 11.2 MIPS
- 64K, 128K or 265K bytes direct mapped cache memory
- 1.2 or 1.44MB floppy drive
- Supports Weitek 4167 co-processor
- AT compatible slots: 6 16-bits, 2 8-bit
- Enhanced 101-key keyboard
- 230W power supply
- Hard disk/floppy controller
- Phoenix BIOS
- Optional 40MB-700MB hard drives, support ESDI, SCSI, IDE, MFM and RLL controller
- 5 storage spaces for floppy and hard drives
- Optional TRW on-site service

DATA-386 20 \$1630



- Intel 80386 20MHz CPU with 1MB of RAM expandable to 16MB
- Supports 80387 and 80287 coprocessor
- 1.44MB or 1.2MB floppy drive
- Optional 40MB-700MB hard drives, support ESDI, SCSI, IDE, MFM, RLL controller
- Enhanced 101-key keyboard
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VIDEO DATA PROJECTORS: SUMMARY OF FEATURES

Products listed in ascending price order

General features All the units tested can be used for floor or ceiling mounts and set up for either front or rear projection.

Lens composition Some projectors use all-glass lenses, but most use a hybrid design of glass and plastic. Glass lenses are potentially capable of brighter and sharper images, but they are more expensive than the hybrid lens assemblies.

Number of fans A steady air supply can help maintain relatively even temperatures and prevent heat-related problems. All but one of these units have multiple internal fans that run constantly.

FCC certification class Many of these products originated in the video marketplace, entering the computer arena later. As a result, not all vendors have sought FCC approval.

Display size indicates the range of image sizes possible, and **focal distance** the range of distances from projector to screen that will

achieve these images. Keep in mind that the amount of light coming from the projector is more or less constant, so a larger screen size will result in a dimmer image.

Maximum resolution Data projectors can display images with varying resolution. This table cites the manufacturer's specification for each projector.

Horizontal and vertical scan frequencies

The listed frequencies are the manufacturers' specifications. For reference, CGA requires a horizontal frequency of 15.75 KHz, while VGA requires 31.5 KHz.

Rated brightness There is no standard method of measuring a data projector's brightness. The numbers reported here often represent optimized settings, in which a small area of bright white is displayed on the center of the screen and the results are extrapolated for the entire image area.

These measurements are typically made with the brightness control turned all the way up; the

image quality would be extremely poor if you were to use the projector at this setting. A low number for this item is more likely a sign of conservative measurement by the manufacturer than an indication of a real difference between projectors.

Display modes supported Most of the projectors can support all the modes listed here in one way or another. In the table, this item refers specifically to the projector's ability to accept a signal directly from the computer's display adapter. If the projector includes a video controller or switching unit as a standard item, the answers reflect that feature. If a projector has a negative answer for any of these items, the capability can usually be added via a video controller from the manufacturer or a third-party source.

Horizontal and vertical positions These controls come in two forms. One moves the entire image so that it can be centered on the display. The other controls the red and blue images separately and can be used to make adjustments in convergence.

	Sony VPH-1031Q	VideoBeam 3000	NEC DP-1200S	Imager 310	Esprit Model 535S	Barcodata 600
List price	\$8,575	\$9,300	\$11,300	\$11,397	\$11,500	\$11,995
GENERAL FEATURES						
Dimensions (HWD, in inches)	23.5 x 21 x 11.1	29.5 x 25 x 9	27.5 x 24.25 x 12.5	27.5 x 25.25 x 11.25	29.2 x 21 x 7.8	32.7 x 22.25 x 9.25
Weight (pounds)	83	70	121.3 (plus 13.3 for controller)	112 (plus 13.3 for switcher)	100	48
Lens composition	Hybrid	Hybrid	Glass	Glass	Hybrid	Hybrid
Power supply rating (watts)	215	300	280 (30 for controller)	280 (30 for switcher)	400	280
Number of fans	2	None	4	4	2	2
FCC certification class	A	A	A	A	None	A
Warranty	1 year parts, 90 days labor, 2 years CRT	1 year parts and labor	1 year parts, 6 months labor	1 year parts and labor; 2 years CRT	1 year parts and labor	1 year parts, 90 days labor, 180 days CRT
VIDEO FEATURES						
Display size in inches:						
Horizontal (minimum/maximum)	54/200	68/68	54/96	56/96	48/240	39.6/60
Vertical (minimum/maximum)	39/150	51/51	42/72	42/72	36/180	30/180
Focal distance in feet (minimum/maximum)	7.5/26.4	8/8	7/12	7/12	6/30	5.74/27.95
Projector technology	Liquid-cooled 7-inch CRT; 5.5-inch phosphor area	CRT-Novatron	Liquid-cooled 7-inch CRT; 5.5-inch phosphor area	Liquid-cooled 7-inch CRT; 5.5-inch phosphor area	Liquid-cooled 7-inch CRT; 5.5-inch phosphor area	Liquid-cooled 7-inch CRT; 5.5-inch phosphor area
Maximum resolution (pixels)	1,024 x 500	1,600 x 1,200	1,024 x 768	800 x 350	1,024 x 768	1,024 x 760
Horizontal scan frequency (KHz) (minimum/maximum)	15/36	14/38	15/36	15.75/36	14/36	15/42
Vertical scan frequency (Hz) (minimum/maximum)	40/150	40/100	38/100	38/100	40/100	50/100
Rated brightness (lumens)	300 (small area, bright white)	500 (peak center brightness)	475 (peak white) peak white)	575 (small area, white)	600 (20% peak white)	600 (10% peak white)
Display modes supported:						
Hercules	☐	☐	☐	☒	☐	☒
CGA	☒	☐	☒	☒	☒	☒
EGA	☐	☐	☒	☒	☒	☒

■—Yes □—No

HARDWARE

DATA PROJECTORS

Text color This lets you selectively turn off one or more of the beams. In this manner, you can project a single color when showing text—such as green on a black background—which can make for a more legible display.

Convergence controls Mechanical adjustments are made to the lens positions so that the beams are focused on all points of the screen. Analog controls are typically potentiometer controls that must be adjusted using a screwdriver or alignment tool. Digital controls permit convergence settings using control-panel or remote-control buttons. Some digital convergence designs have on-screen prompting for the convergence procedure.

Maximum number of convergence settings stored Stored convergence settings permit optimal adjustments for different signals. In some cases the various settings are linked to input sources; in others they are linked to the different video-signal frequencies used by various display modes.

Mitsubishi VS-1250FI	ECP 3000
\$14,300	\$14,400
26.5 x 23.5 x 12.2	25 x 24 x 17.25
119	109
Glass	Hybrid
300 (50 for controller)	450
4	2
A	A
6 months parts, 90 days labor, 2 years CRT	1 year parts and labor
56/96	48/240
42/72	36/180
7/12	6/27.67
Liquid-cooled 7-inch CRT; 5.5-inch phosphor area	Liquid-cooled 7-inch CRT; 5.5-inch phosphor area
750 x 580	1,280 x 1,024
15.6/36	15/55
50/100	45/120
675 (peak white)	650 (10% peak)
□	Optional
■	Optional
■	Optional

CONTINUES

This difference affected the benchmark testing so that the AmPro results appear much brighter than the competitors.

The display area of the VideoBeam was about half as large as the test size, and thus *should* be at least twice as bright as the competitors whose light was spread over twice the area.

OTHER DIFFERENCES

Another major difference between the VideoBeam and the others is that it uses its own CRT technology. The tubes use a Schmidt Optical System design, similar to that used in large telescopes.

The image is created by bombarding a phosphor-coated target with the picture aimed back toward the inside of the projector. The image is reflected by a circular mirror that forms the back of the tube, which is then focused by lenses at the front surface of the tube.

According to AmPro, this design allows for a much brighter image; extrapolating from our test results indicates that even after accounting for the smaller image size, this might well be the case. Another benefit is that these tubes run much cooler than conventional designs. The VideoBeam is the only unit that did not rely on internal fans for cooling.

The unit's performance was adequate, but not much better, given its advantage of a smaller image size. The convergence settings were the worst of the units tested, though the severity of this is minimal and is probably due to setup procedures.

The biggest failing in terms of performance was the image itself—it lacked the crispness and detail that some others had. The flaws were most apparent on a text screen with rows of black lowercase m's on a white background. The background between the letters dropped out badly, making a dark gray band out of each line of text.

CONVERGENCE

Convergence is done by using potentiometers inside the case. This might be difficult in a ceiling-mounted installation; a hand-held remote would be easier to use. There is only one setting, and the manual recommends that the alignment be accomplished by using the "most critical source" since "there may sometimes be a slight shift in dynamic convergence when switching between sources of different scan rates." This is an area

FACT FILE

VideoBeam 3000

AmPro Corp., 35 Cabot Rd., Woburn, MA 01801; (617) 932-4800.

List Price: Projector; leg for tabletop installation; NTSC input module; choice of Quad-standard, RGB analog, Mac II, PS/2, or EGA connector module: \$9,300.

Options: Wired remote with 30-foot cable, \$240; with 50-foot cable, \$300; with 100-foot cable, \$340; wireless remote, \$500; input modules for RGB analog, TTL, or S-VHS video, \$480 to \$625; ceiling-mount kit, \$300; projection cart, \$360.

In Short: The AmPro VideoBeam 3000 has a low price and some interesting features, but it is hampered by its fixed-focus design, limited convergence controls, and mediocre image. In spite of its low cost, other projectors represent a better value.

CIRCLE 396 ON READER SERVICE CARD.

where the competitors' multiple setting capabilities are an advantage.

The AmPro VideoBeam 3000 is an interesting projector with some advantageous features. Unfortunately, the inflexible image size, the old-fashioned convergence controls, and the less-than-ideal image outweigh its low price. Unless you need a projector that can be set up a bit faster than the others, the VideoBeam does not have any compelling reasons to consider it over the competition.

BARCO INC. Barcodata 600

With a list price of \$11,995, the Barcodata 600 ranks as a midpriced model. While this price includes some useful

FACT FILE

Barcodata 600

Barco Inc., 1500 Wilson Way, Smyrna, GA 30082; (404) 432-2346.

List Price: Projector, \$11,995; projector with RCVDs 400 Quad switcher, two video input and three RGB analog input modules, \$13,995. Quad-standard 15-MHz RGB video decoder available at no extra charge.

Options: All glass lenses, \$2,350; ceiling mount, \$485; projector cart, \$675; RCVDs infrared remote for switcher, \$195; input modules for video, RGB analog, TTL, \$170 to \$280; projector transit case, \$450.

In Short: The Barcodata 600 carries a mid-range price but no extras; many installations will require additional items and may want to consider Barco's complete bundled system price. The image is acceptable, but the setup features have some limitations.

CIRCLE 397 ON READER SERVICE CARD.

HARDWARE

DATA PROJECTORS

extras, the unit is primarily a building block that you can expand to a complete system.

The projector relies on banks of internal potentiometers for alignment and convergence. There are four groups of them so that you can set the beams for four different input signals, corresponding to the various signal frequency ranges—15 kHz to 32 kHz and 32 kHz to 42 kHz. The projector adapts an image within those ranges, but the adjustments must be made

at the projector with the cover removed. This can be inconvenient, especially when the system is set up as an overhead installation.

The back of the projector accepts two different types of signals: digital and analog RGB. The digital connector is a standard 9-pin D-connector that can connect a CGA or EGA cable directly. The analog connector requires separate BNC-coax con-

nectors for the red, green, blue, and synch signals. There is also a coax connector for composite video.

While all these inputs seem useful, many installations will require additional features. If you want to run the connection between your computer and the projector at a long distance (more than 10 feet, according to one industry source), you will not be able to rely on digital RGB signals. If you use a VGA analog signal, you will need a special cable that ends in



VIDEO DATA PROJECTORS: SUMMARY OF FEATURES

Products listed in ascending price order

	Sony VPH-1031Q	VideoBeam 3000	NEC DP-1200S	Imager 310	Esprit Model 535S	Barcodata 600
VIDEO FEATURES						
VGA	☐	☒	☒	☒	☒	☒
Other	Composite	Mac II, NTSC composite, Super VGA	Composite, S-Video	Composite, S-Video	Composite, S-Video	NTSC composite, RGB analog, S-Video
Pass-through video signal	☐	☐	☐	☐	☒ (TTL only)	☐
INPUT/OUTPUT CONNECTIONS						
25-pin serial	☐	☐	☐	☐	☒	☐
Digital video:						
Signal in from PC	☒	☐	☒	☒	☒	☒
Signal out to monitor	☐	☐	☐	☐	☒	☐
Analog video:						
Signal in from PC	☒	☒	☒	☒	☒	☒
Signal out to monitor	☐	☐	☐	☒	☐	☐
Composite video:						
Signal in from PC	☒	☒	☒	☒	☒	☒
Signal out to monitor	☐	☐	☐	☐	☐	☐
Other	Audio in	Audio in/out	Audio in/out, external control, wired remote	Audio in, external control, wired remote	Wired remote	Wired remote
CONTROLS (ON UNIT OR REMOTE)						
Contrast	☒ (on unit)	☒ (on unit)	☒ (both)	☒ (both)	☒ (remote)	☒ (on unit)
Horizontal position:						
Per color	☒ (on unit)	☒ (on unit)	☐	☐	☐	☐
Entire image	☒ (on unit)	☒ (on unit)	☒ (on unit)	☒ (on unit)	☐	☐
Vertical position:						
Per color	☒ (on unit)	☒ (on unit)	☐	☐	☐	☐
Entire image	☐	☐	☐	☐	☐	☐
Color	☒ (on unit)	☒ (on unit)	☒ (both)	☒ (both)	☒ (remote)	☒ (on unit)
Tint	☒ (on unit)	☒ (on unit)	☒ (both)	☒ (both)	☒ (remote)	☒ (on unit)
Brightness	☒ (on unit)	☒ (on unit)	☒ (both)	☒ (both)	☒ (remote)	☒ (on unit)
Reverse	☐	☐	☐	☐	☐	☐
Text color	☐	☒ (on unit)	☒ (on unit)	☒ (on unit)	☐	☐
Focus	☐	☒ (on unit)	☒ (on unit)	☒ (on unit)	☐	☐
Power	☒ (on unit)	☒ (on unit)	☒ (both)	☒ (both)	☒ (remote)	☐
Blank screen	☐	☐	☐	☐	☐	☐
Other controls on the unit	Convergence, level, sharpness, source select, superimpose video on RGB image	Detail, internal speaker switch, source select, test pattern, vertical blanking, volume	Sharpness	Sharpness	None	Fast/slow synchronization, horizontal size, sharpness, source select
Other remote controls	None	None	Convergence, source select, test pattern	Convergence, source select, test pattern	Convergence, detail, phasing, source select, standby, test patterns, volume	None
Convergence controls:						
Mechanical	☒	☐	☒	☒	☒	☒
Analog	☒	☒	☒	☐	☒	☒
Digital	☐	☐	☒	☒	☐	☐
Maximum number of convergence settings stored	1	2	8	8	8	4

☒—Yes ☐—No

BNC connectors. Finally, the Barcodata has no standard provision for hooking up a separate monitor.

All these limitations point toward the fact that you will want to add a video switcher or controller unit to complete your system. (These are available from Barco and third-party sources and will add \$500 to \$2,400 to the total cost.) Barco also offers a complete system that includes a high-end switcher with the Barcodata 600 for \$13,995. An optional

HARDWARE DATA PROJECTORS



The Barcodata 600 relies on banks of internal potentiometers for alignment and convergence. There are four sets in all, so the beams can be set for four different input signals corresponding to the signal frequency ranges—15 kHz to 32 kHz and 32 kHz to 42 kHz.

infrared remote is available for Barco's switcher for an additional \$195.

MIXED DISPLAY RESULTS

In our tests, the Barco was slightly brighter than some of the others. This result, however, can be attributed to differences in settings rather than any inherent design aspect of the projector.

The lack of real difference in brightness is supported by the fact that the Barcodata's projected lines were broader and fuzzier than some of the dimmer projectors. This would indicate that the Barco technician had merely set the brightness control a bit higher than did the technicians working on some of the other machines.

The projector's display produced mixed results. The colors were clear and vivid, but the image suffered a bit when it came to lowercase m's on the text screen; the white background turned a bit gray between the black letter m's, making the image less crisp and legible.

One of the good points about the projector is that it is designed for easy maintenance. The circuit is designed in re-

movable modules so that technicians can simply swap out any failed parts without having to remove the entire projector. Barco even built in a goosenecked map light in order to provide a light source for those who are adjusting or servicing the projector.

Ultimately, the Barcodata 600 is a good projector, producing an average image. It tends to be somewhat more difficult to set up and costs a little more (since in most cases, you'll need to purchase extra items) than some of its competitors. It's an acceptable value, but not a compelling attraction.

ELECTROHOME LTD. ECP 3000

The ECP 3000 from Electrohome looks more like the head of a life-size toy robot than a technical device. Standing on its own integral pedestal, this \$14,400 data projector has some futuristic features inside as well.

The system stands out from the start. The technician who came in to set up the



The remote for Electrohome's ECP 3000 includes a Help button. There are dozens of screens of context-sensitive help that cover the entire alignment and convergence process. The remote also has function keys that allow you to access the different setup operations.



Mitsubishi VS-1250R ECP 3000

■ Composite, Mac II, PGA, S-Video	Optional
■ (at controller)	None
□	Optional
■	□
□	□
■	■
■	□
□	□
Audio in/out	External infrared remote control

■ (on unit) ■ (both)

■ (on unit)	■ (both)
■ (on unit)	■ (both)

■ (on unit)	■ (both)
■ (on unit)	■ (both)
■ (on unit)	■ (both)
■ (on unit)	■ (both)
■ (on unit)	■ (both)

□	■ (both)
□	■ (both)
□	■ (both)
■ (on unit)	■ (both)
□	■ (both)

Color select, convergence, function keys for on-screen menu, sharpness.	Convergence, detail, help, source select, recall, volume
---	--

None	Same as on-unit controls
------	--------------------------

■	■
■	□
■	■
2	24

ENDS

HARDWARE

DATA PROJECTORS

ECP 3000 didn't remove the case and reach for a screwdriver or alignment tool; he simply turned on the power and took hold of a remote control that resembles your home stereo or VCR control. As you might expect, the remote control gives you authority over some fundamental factors: power, brightness, contrast, color, tint, and detail. Since nearly every data projector can also handle composite video signals, you won't be shocked to find a volume button on it.

But would it surprise you to discover a Help button on the remote? Press it and you see a screenful of information on how

to set up the projector's image. In fact, there are dozens of screens of context-sensitive help that cover the entire alignment and convergence process. The remote also has function keys that allow you to access the different set-up operations. For many of these tasks, a bar graph appears on-screen, moving interactively in response to the settings you specify.

The ECP 3000 relies on digital convergence. There are a few potentiometers inside the case, but these are preset at the factory and should never need adjustment.

Aside from mounting the projector and making some mechanical adjustments to lens positions, you should never have to touch the projector again. (Of course, you can make your settings without the remote if you wish, as all its controls are duplicated on the back panel of the projector). The ECP 3000 also offers zone convergence: 25 different spots on the screen can be adjusted so that the three beams overlap precisely.

INTELLIGENTLY CRAFTED

The projector allows you to create and store convergence settings for different

Telecomputing, the Presentable Way

by Alfred Poor

The scene: Your data projector is installed, carefully aligned, and your slide show is ready to run. You dim the lights as an expectant hush falls over the audience—suddenly, breaking the silence, is your heart-wrenching scream as you trip over tangled cables on the way to your PC's keyboard.

It's small consolation, but you wouldn't be the first person to fall victim to the perplexing problem of positioning your keyboard, computer, and projector so that they are unobtrusive, yet operable. You may be more comforted by the fact that today, many products on the market address this issue. Here are a few ideas that can make life in front of the big screen easier.

KEYBOARD ALTERNATIVES

Most people don't like to be nailed to one spot while giving a presentation, but most keyboards aren't designed to be carried around. Even with a cable extension they're heavy and clumsy to hold and you run the risk of tripping on their tether. An assistant can sometimes press keys for the presenter, but even when you can afford that luxury, it's difficult to coordinate actions.

A better solution may be a handheld remote control. Just like the units that control a VCR or television, these battery-powered devices signal your computer via invisible, infrared light; a receiver plugs into your computer and translates these signals into keystrokes. One added advantage of infrared beams is that they can be bounced

off light-colored surfaces, like a projector screen or blank wall. As a result, you can often operate them even when your back is turned to your computer. Two examples of these are Presentation Electronics' SilentPartner (\$349) and Forté Communications' Remote Keyboard (\$395).

In many respects, the two remotes are similar. Both of them are about the same size—approximately 6 by 2.5 by .75 inches (LWD). In short, they are easy to handle and small enough to fit into a shirt pocket. Both let you program buttons to represent various keystrokes. They each come with predefined sequences, but you can define your own—like a keyboard macro program—which means you can execute commands to run live demos of programs.

The SilentPartner's receiver can plug into either the keyboard port or a serial port. A Presenter Pack, bundled with the SilentPartner for \$419, includes an external power supply (as well as handy cables)

for users who opt for the serial route. The Remote Keyboard works only with a serial port.

If you should decide that you need a keyboard's full range of options (or that you don't want to memorize which button on your remote has been programmed for which keystrokes), consider nVIEW's \$495 Toteboard. This 100-key device weighs under a pound and a half and gives you all the keys on your desktop keyboard arranged in a layout less than 11 inches wide. The function keys and cursor keys, along with a numeric keypad, are at the top edge of the unit.

The Toteboard has no cord. Like the pocket remotes, it communicates to a receiving unit via infrared light. It is designed to be used as you walk and a provision for one-handed typing lets you execute shifts and Ctrl-key combinations with one finger. The unit can be programmed to address any of eight different



Forté Communications' Remote Keyboard, Presentation Electronics' SilentPartner, nVIEW's Toteboard, and General Parametrics Corp.'s VideoShow.

HARDWARE

DATA PROJECTORS

signals—up to 24—from sources like VCRs or various computer display adapters. This is only part of the system's intelligence, though.

Many installations, for instance, require multiple screens to be active at once. One example is CSX Transport's Transportation Center in Florida, where banks of Electrohome projectors display graphic information that is used to control approximately 20,000 miles of railroad. The projectors don't get confused because each one is programmed to answer a specific ID number; the remote lets a user specify which ID number is to be active,

and once specified the remote affects only that projector.

The ECP 3000 has a modular design. It comes equipped with an input module that accepts RGB analog signals, either through BNC-coax connections or a special 10-pin connector. Most installations will require additional modules, such as a digital RGB for CGA or EGA, or an analog RGB with a connector designed for VGA input. Input modules carry a list price of from \$255 to \$295.

Some installations, especially those that

receivers, and you can specify which receiver you intend to signal with function-key commands.

While all of these devices can transmit signals through a rear screen—letting you eliminate clutter by positioning the data projector and PC behind the wall—the Toteboard helps you avoid fumbling with the PC or its keyboard at all.

PLUG AND PLAY

If you want to be rid of your PC completely when it's time to make your presentation, you may be interested in General Parameterics Corp.'s VideoShow.

Your first step is to create your slide show (using nearly any popular PC or Macintosh art program) and save it to disk. Then just take the disk and pop it into the VideoShow (you might choose a model that supports Macintosh and PC 3.5-inch floppy disks or 5.25-inch floppy disks), press some buttons on the system's infrared remote, and your show is on the screen. Since the machine can connect to digital or analog RGB devices, or even composite video, you can use anything from a VCR/television combination to a computer monitor and an LCD panel to a data projector to display your handiwork.

You'll want to use a good color display, however, as the VideoShow is capable of a 2000- by 500-dot display, with a theoretical limit of 100,000 simultaneous colors. The real magic is that this is accomplished with a signal that has a horizontal scan rate of just 15.5 kHz—about the same as CGA or composite video. You can get an excellent image from even a

low-cost video projector. There's no need to spend money on a more costly, higher-frequency data projector.

The VideoShow comes in a variety of models ranging from just under \$4,000 to nearly \$9,000. This can be as much or more than you spend on a projector, but the high-quality output can make the expense worthwhile. ■



FACT FILE

Remote Keyboard

Forté Communications, 680 W. Maude Ave., Sunnyvale, CA 94086; (800) 331-3903, (408) 733-5100.

List Price: \$395

Requires: 12K RAM, serial port, DOS 2.1 or later.

CIRCLE 405 ON READER SERVICE CARD

SilentPartner

Presentation Electronics Inc., 4320 Anthony Ct., #8, Rocklin, CA 95677; (916) 652-9281.

List Price: \$349; with Presenter Pack, serial connectors, and external power supply for receiver, \$419.

Requires: 256K RAM, monitor, graphics adapter, DOS 2.0 or later.

CIRCLE 404 ON READER SERVICE CARD

Toteboard

nVIEW, 11835 Canon Blvd., Newport News, VA 23606; (804) 873-1354.

List Price: \$495.

Requires: Keyboard or serial port.

CIRCLE 406 ON READER SERVICE CARD

VideoShow

General Parameterics Corp., 1250 Ninth St., Berkeley, CA 94710; (800) 223-0999.

List Price: VideoShow Executive, \$3,995;

VideoShow 180 Professional, \$8,995.

Requires: Varies with model; contact vendor.

CIRCLE 407 ON READER SERVICE CARD



FACT FILE

ECP 3000

Electrohome Ltd, 809 Wellington St. North, Kitchener, Ontario, Canada N2G 4J6; (800) 265-2171, (519) 744-7111.

List Price: Projector, infrared remote, dual input analog RGB module, \$14,400.

Options: Projector cart, \$499; ceiling mount, \$355; executive model infrared remote, \$100; wired remote, \$150; remote sensor, \$150; infrared remote video/data switcher, \$1,595; input modules for video, RGB analog, TTL, \$255 to \$295.

In Short: The Electrohome ECP 3000 has one of the highest list prices, but it has the intelligence and high-level specifications to match. It produced a good image in our tests, and while it is not an outstanding value, it is a reasonable choice.

CIRCLE 398 ON READER SERVICE CARD.

have ceiling mounts, may need a separate switcher or controller; depending on the vendor (either Electrohome or third-party) and level of complexity, this can add between \$600 and \$2,500 to the total system.

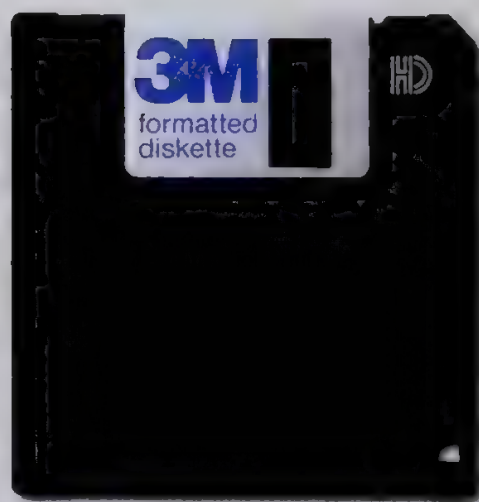
The Electrohome projector produced a good image, although the setup may have boosted the blue gun's signal just a little bit too much. Still, the individual dots were smaller and smoother than the ones that some of the other projectors produced. The Electrohome also proved to be one of the best of the bunch at displaying black m's on a white screen; the white background held steady between the letters and did not bleed into gray as did many others.

The ECP 3000 has some interesting specifications, including the highest-rated vertical and horizontal frequencies—120 Hz and 55 kHz, respectively. Theoretically, these specifications make it the highest-resolution model tested here. It is also one of the most expensive systems we tested, but given its smarts and the good-quality image it produces, it is a reasonable choice for anyone who can afford it.

GENERAL ELECTRIC Imager 310 NEC TECHNOLOGIES INC. DP-1200S

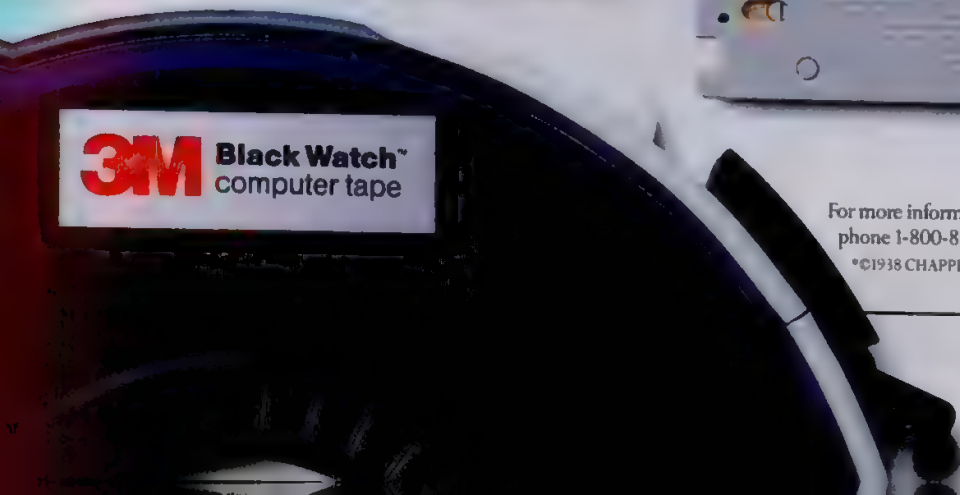
The biggest differences between these two projectors are a few dollars, a few accessories, and the fact that General Electric's Imager 310 has a slightly catchier name than NEC's DP-1200S. Actu-

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3M

HARDWARE DATA PROJECTORS

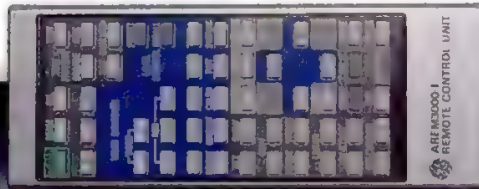
ally, both systems are made by NEC; GE just puts its nameplate on the model that is sold through its own channels. NEC tags its system at \$11,300; GE's price is slightly higher at \$11,397.

A few details set these machines apart from the others reviewed here. One fundamental difference is that aside from the AmPro VideoBeam, these are the only projectors that do not use the Sony 7-inch, liquid-cooled CRTs with a 5.5-inch phosphor area. Instead, they use NEC's 7-inch, liquid-cooled CRTs. These also have a 5.5-inch phosphor area and are de-

signed to operate with essentially the same specifications as the Sony tubes.

signed to operate with essentially the same specifications as the Sony tubes.

NEC goes one step further in the accessories department. Both prices include the projector, the switcher, infrared remotes,



The GE Imager 310 works with inputs from CGA through VGA. It's all-glass lenses create a sharper image at the center of the screen than the hybrid plastic and glass lenses of its competitors. But the trade-off is some loss of resolution in the corners.



MORE DIFFERENCES

Other differences are functionally oriented. Along with the Mitsubishi model, these systems are the only ones to include a separate video switcher as part of the package (Barco offers a similar bundle as an option). The controller accepts a wide range of inputs, including a 9-pin connector that can be set to either TTL (digital) or analog signals. It can accept signals with scan rates from 15 kHz to 36 kHz, so it will work with everything from CGA and EGA to PGA and VGA.

These projectors use digital convergence, so there's no fiddling with potentiometers inside the projector case. All adjustments are made on-screen using a remote control; both companies include two infrared remote controls. The first, a full-featured model, sports all the convergence controls and function keys. The GE carries the polite euphemism Executive Remote Control (NEC calls it a User Remote Control and includes only the basics). GE actually has fewer buttons on its Executive Remote.

In addition to the standard convergence operations, these projectors also

and the cables to connect the switcher to the projector. But NEC includes a tethered remote (which has a wire that plugs into the switcher), cables to connect to either 9- or 15-pin video adapter cards, a ceiling-mount kit for the projector, and

FACT FILE

Imager 310

General Electric, Projection Display Products Operation, Electronics Park 6-338, Syracuse, NY 13221; (315) 456-2152.

List Price: Projector, switcher, two infrared controllers, one set of RGB cables, 25-pin switcher-to-projector cable, \$11,397.

Options: Ceiling mount, \$120.

CIRCLE 399 ON READER SERVICE CARD

NEC DP-1200S

NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191-1094; (800) 562-5200 ext. NEC, (312) 860-9500.

List Price: Projector, glass lenses, ceiling mount, three remote controls (two infrared, one wired), video switcher, cables for switcher to projector, 9-to-9 pin (IBM PC) and 9-to-15 pin (PS/2) computer adapter cables, ceiling mount kit, rack mounts for controller, \$11,300.

Options: Local VGA computer monitor hookup, \$500.

In Short: Both the NEC DP-1200S and the GE Imager 310 were solid performers on our tests, and both of the units offer good value for the price, including the ease of digital convergence and the flexibility of an external video switcher. Either one of them would be an attractive selection.

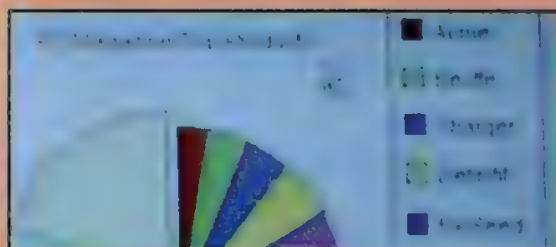
CIRCLE 400 ON READER SERVICE CARD.

rack mounts for the switcher. If you purchase the GE unit, you can still get these items, but at extra cost.

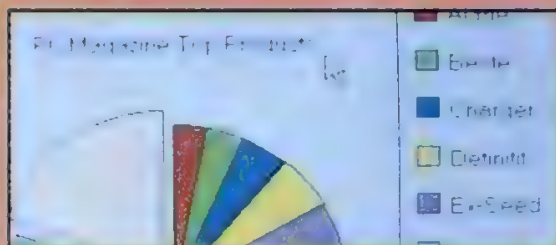
IDENTICAL RESULTS

On our benchmark tests, both projectors performed about the same. The results show a somewhat brighter image for the NEC, but this merely indicates the subjective nature of the test; the brightness lev-

PRECISE BEAM ALIGNMENT: The Key to High-Quality Images



Sony VPH-1031Q



Standard VGA monitor

The single most important factor in data projector image quality is the way a unit is set up and aligned. The three beams must be carefully adjusted so that the projected images converge precisely on the screen—achieving this is as much an art as it is a science. A properly adjusted unit will reward you with a clear and vivid image, such as the one created with the Sony VPH-1031Q. The data projector image is nearly as good as that of the VGA monitor shown at left, but much more impressive because of its size. Here we show details at a 1:1 ratio.

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HARDWARE

DATA PROJECTORS

els are largely influenced by the taste and judgment of the technician who set up each unit.

Both systems produced good images, although each had trouble with the lower-case-m screen where lines of black text are shown on a white background: the white between the letters smeared to a moderate gray, therefore losing legibility. Since these were two of the three projectors that used all-glass lenses instead of the more common hybrid glass and plastic lenses, it's not surprising that each tended to make dots at the corner of the screen appear elongated. All-glass lenses tend to lose some resolution in the corners, but

standard PC screen. This means that you can monitor CGA or EGA images on the small screen—a benefit for presentations where you must face the audience, operating a computer with your back to the projection screen.

This feature is of less value if you are considering an overhead installation or planning to use analog VGA signals. In such cases, you will need to rely on a switcher or interface unit. These are available from third-party sources or from Gretag; the company's range of devices are priced between \$450 and \$2,700.

The NEC DP-1200S is functionally identical to the GE Imager 310, but its basic list price includes a tethered remote unit, plus cables, a ceiling mount kit, and rack mounts in addition to the basic projector.



provide a sharper image in the center of the screen.

Either of these projectors is a good choice. The GE model has the advantage of a longer warranty—one year of labor to NEC's six months, and two years for the CRT tubes to NEC's one year. NEC, however, provides greater value by offering more items for a slightly lower price. If you can use the extra features that come standard with the NEC, that system certainly holds the edge.

GRETAG IMAGE SYSTEMS Esprit Model 535S

Like many of the units we tested, the \$11,495 Gretag Esprit 535S has inputs on the projector's back panel; it handles composite video, analog RGB through BNC connectors, and 9-pin digital RGB. The unit also has a serial port and a connector for the wired remote control.

What sets the system apart from others is its pass-through capability for digital RGB signals. A 9-pin output port on the back of the projector lets you hook up a

The Esprit also distinguishes itself from other systems. It has the dubious distinction of being the only projector in this group without FCC Class A certification (which does not necessarily mean that it will create problems with radio frequency noise).

The projector does not come with an infrared remote; that and its receiver are a \$325 option. The included wired remote does, however, give you control over the basic projector functions.



FACT FILE

Esprit Model 535S

Gretag Image Systems, 1301 Armstrong Dr., Titusville, FL 32780; (800) 327-3644, (407) 269-6690.

List Price: Projector, wired remote, \$11,495.

Options: Ceiling mount, \$200; projection table, \$695; carrying case with castors, \$550; glass lenses, \$4,000; rack mounted switcher, \$2,495; table case switcher, \$2,695; computer interface modules (do not require switcher) for RGB analog, \$450 to \$620; standalone Quad video decoder, \$1495; infrared remote and receiver, \$325.

In Short: Gretag's Esprit Model 535S has a midrange price, with some useful features and a great picture that are, however, offset by analog alignment controls and the fact that some important items are available only at extra cost. The new product line slated for introduction in 1990 should add digital convergence, which will help make this projector more attractive.

CIRCLE 401 ON READER SERVICE CARD.

FUTURE AND PRESENT CONDITIONS

The Model 535S can store eight different alignment settings. Alignment and convergence settings are done through analog potentiometers in the projector—a drawback for some installations, especially ceiling mounts. Gretag plans to release an upgraded line of projectors early in 1990 (in fact, the systems may be available by the time you read this); the Esprit 535S will be replaced by the 1535 with complete digital alignment and convergence controls, which should make setup more convenient.

One good reason why PC users might be interested in the model we reviewed is that it produces an excellent image. The system performed very well on our tough text test featuring black lowercase m's on a white background. While many other projectors tended to smear the text lines, their backgrounds turning gray and damaging legibility, the Esprit's background

What sets Gretag's Esprit Model 535S apart is that it can pass-through digital RGB signals to a standard PC screen via a 9-pin output port on the back of the projector. This can be an advantage for presentations where you must face the audience, operating a computer with your back to the projection screen.

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PERFORMANCE TESTS: VIDEO DATA PROJECTORS

How well data projectors perform depends largely on a single factor: the skill of the person who does the setup. The benchmark test figures—particularly those for the identical NEC and GE products—underscore this fact. They also demonstrate that all of these units are capable of producing approximately the same quality and level of brightness for a given image size. As a result, selection should be made mostly on the bases of where you buy your projector and the features it offers.

CONTINUES

stayed light between the letters.

Additionally, the Espri's modular electronic design means that maintenance and repair should be quick and easy. Gretag capitalizes on this by offering a field upgrade from the lower-resolution Model 300 to the Model 535S.

The Gretag does not include a great many accessories, but its pass-through feature can make it a good choice for some installations. The good image and fairly reasonable price (even with the extra cost of some options) of the existing system are commendable, and the addition of digital convergence to the new product line may make Gretag's systems even more attractive.

MITSUBISHI ELECTRIC SALES AMERICA INC. Mitsubishi VS-1250R

The Mitsubishi VS-1250R doesn't sport a flashy name to draw your attention to it; instead, this soberly titled system quietly goes about business. At \$14,300, it's costly, but it includes some useful features that make the cost reasonable.

The projector itself is unusual in that it has only one set of video inputs: BNC connectors for RGB and sync signals. There is also a D-connector for a cable

In order to minimize subjective variations, all the projectors were tested under identical conditions by the same person.

The test-bed included an IBM AT operating at 8 MHz and an IBM VGA display adapter card. We also made available a video controller—the RGB 202 Universal TTL/Analog/ECL Computer Graphics Interface from Extron Electronics (13554 Larwin Circle, Santa Fe Springs, CA 90670; (213) 802-8804). In addition to this unit, valuable technical assistance was provided by Extron for this project.

Prior to our testing, all vendor representatives took between one and two hours to set up and align their systems. Some chose to use their own video interface, others made use of the Extron RGB 202, and still others went directly from the VGA output to their projector. Once the technician was satisfied with a projector's settings, we took the test measurements. No adjustments to the settings were permitted once the measuring process had begun.

that connects to the external controller.

As it turns out, this design works well. By bundling an *external* controller, the VS-1250R can work as well with the projector on the ceiling as on the floor. You can attach various analog and digital RGB video signals to the inputs on the controller and it will send them on to the projector. Unlike systems where the multi-frequency circuitry is contained in the projector, the Mitsubishi relies on the controller to convert the signal to a steady scan rate. In this case, all signals are converted to 31.5 kHz.

Some tasks must be performed at

the projector. The alignment and convergence settings are adjusted by setting banks of potentiometers inside the case. When the projector is mounted from the ceiling, this process could be decidedly more difficult than if the system relied on digital convergence controls.

The VS-1250R shows some extra smarts in the adjustments it allows you to make at the controller. The Function key on its panel calls up on-screen menus that let you alter brightness and contrast settings. Up to 12 different settings may be stored, so you can tune the controller for a variety of input sources.

CONTROLLER SMARTS

The controller also has the capability to pass-through an analog RGB signal to a monitor. This can be extremely useful when you must operate a keyboard but can't watch the projected image. Since the pass-through connector is part of the controller and not on the projector, you have more flexibility in choosing a place to set your computer and monitor.

The VS-1250R produced a fairly good image. It did not look quite as sharp as some of the others, but this appeared to be because the brightness on the blue tube was turned up a bit higher than the green and red beams. (According to one industry source, the blue light is difficult for the human eye to register accurately. As a result, some technicians give an extra boost to the blue signal, furnishing the image with increased brightness and covering any small errors in converging the blue beam with the red and green beams.)

The image showed a touch of a gray effect between the lowercase m's on our black-on-white text screen. Instead of maintaining the white background, the lines of text tended to wash out a bit, losing some legibility.



The Mitsubishi VS-1250R's design, though it works well enough, is unusual in that it has only one set of video inputs: BNC connectors for RGB and sync signals. There is also a D-connector for a cable that connects to the external controller.

MORE SEQUELS THAN ROCKY.

PC WEEK POLL
OF CORPORATE SATISFACTION
FEBRUARY 12, 1990

16MHz 386SX-BASED PCs	OVERALL WEIGHTED SCORE
Dell System® 316	1
Compaq Deskpro 386S	2
Everex Step 386/s	2
IBM PS/2 Model 55SX-061	4

PC WEEK POLL
OF CORPORATE SATISFACTION
APRIL 10, 1989

20MHz 80386-BASED PCs	OVERALL WEIGHTED SCORE
Dell System 310	1
AST Premium/386E	2
Compaq 386/20e	2
HP Vectra RS/20 PC	4
IBM PS/2 Model 70-121	5

PC WEEK POLL
OF CORPORATE SATISFACTION
FEBRUARY 5, 1990

25MHz 386-BASED PCs	OVERALL WEIGHTED SCORE
Dell System 325	1
HP Vectra RS/25C	2
AST Premium 386/25	3
Everex Step 386/25	3
Compaq Deskpro 386/25	5

PC WEEK POLL
OF CORPORATE SATISFACTION
OCTOBER 24, 1988

386-BASED PCs	OVERALL WEIGHTED SCORE
Dell System 386/16 (PC's Limited)	1
Compaq Deskpro 386 Model 40	2
Zenith Model Z-386	3
IBM PS/2 Model 80	4
WYSEpc 386 Model 3216	4

PC WEEK POLL
OF CORPORATE SATISFACTION
APRIL 17, 1989

80286-BASED PCs	OVERALL WEIGHTED SCORE
Dell System 200	1
CompuAdd 286/12	2
Acer 900	3
Compaq Deskpro 286 Model 1	4
HP Vectra ES/12 PC	4

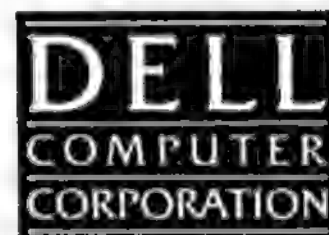
PC WEEK POLL
OF CORPORATE SATISFACTION
OCTOBER 17, 1988

286-BASED PCs	OVERALL WEIGHTED SCORE
Dell System 200	1
AST Premium/286	2
Compaq Deskpro 286	3
Zenith Model Z-286	3
IBM PS/2 Model 50	5

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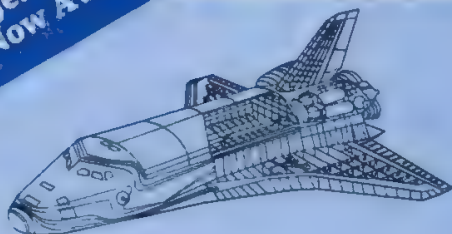
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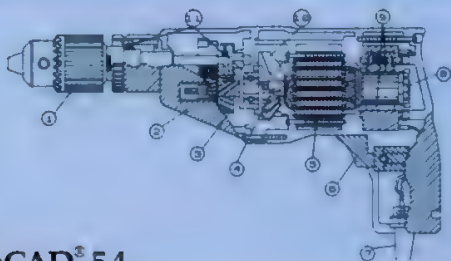
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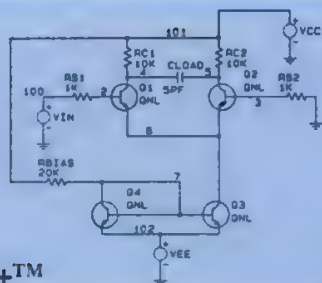
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FACT FILE

Mitsubishi VS-1250R

Mitsubishi Electric Sales America Inc., 800 Cottontail Ln., Somerset, NJ 08873; (201) 563-9889.

List Price: Projector, controller, controller-to-projector cables, \$14,300.

Options: Ceiling mount, \$200; low ceiling mount, \$185; extension arm for ceiling mount, \$500; shipping case with castors, \$555; projector stand with castors, \$825.

In Short: The Mitsubishi VS-1250R is more expensive than most of the others, even considering the fact that it includes a feature-filled video controller. The analog convergence controls detract from its appeal, but it produces a good image and is a reasonable choice.

CIRCLE 402 ON READER SERVICE CARD.

HARDWARE

DATA PROJECTORS

Taking into account the experimental error bracket of these tests, the VS-1250R seems capable of producing about as bright and clear a picture as the other systems. Its price is a little high, even with the included controller, but it still remains an alternative worth consideration.

SONY COMMUNICATIONS PRODUCTS CO. Sony VPH-1031Q

The Sony VPH-1031Q looks a lot like the other projectors in this group, but it is

different in one startling respect: its price. In December 1989, Sony lowered the list price on this unit to \$8,575—more than 40 percent below the \$15,000 ceiling for this project.

True, you don't get a lot of extras with this projector—there are no pass-through connectors that permit you to hook up a local monitor, and neither remote controls nor separate switchers are included. While the system accepts analog and digital RGB signals as well as composite video, you will need a third-party video interface if you want to hook up to an analog VGA adapter. (This can add \$1,000 to an installation.)

Sony itself offers a variety of options,

PERFORMANCE TESTS: VIDEO DATA PROJECTORS

The projectors were set up to produce a 7-foot wide image. The target surface was a large white sheet of paper on a wall, with vertical guidelines 7 feet apart. Light readings were taken with a light meter held against the paper, with room lights turned off to reduce ambient light. Physical measurements were made by marking the paper at the outer edges of the light beam, and using the midpoint of these lines as the measuring point. A ruler marked in decimal inches (as opposed to a typical ruler marked in fractions of inches) was used for the measurements.

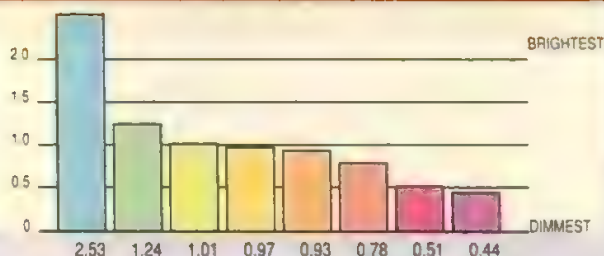
Brightness was measured by taking light readings in five locations on the screen, with a white image displayed. One reading was taken at the center of the image, and one each at the four corners 6 inches in from each edge. These five measures were averaged and reported in footcandles.

Keystoning is a form of distortion in which straightedged images are bowed inward (or outward). Keystoning was measured by projecting a row of white dots along the top edge of the screen. A line was drawn, using an 8-foot long straightedge, between the two end points. The perpendicular distance between this line and the center dot was measured and reported in inches. A lesser number of inches indicates less displacement, and thus, a straighter line.

Convergence Error is a measure of the degree to which the three color beams—red, green, and blue—fail to align on top of each other. The test was conducted by projecting an image of a grid within a rectangle that filled the screen. The centers of the edge lines were marked at the top, bottom, and sides; these marks were made for each of the three beams. (This process was accomplished by either switching off the other two beams, if the projector had this capability, or by physically covering the lenses of two tubes while the light from the third was measured.) The distance was measured from the midpoint of one beam to the midpoints of the other two beams at that edge. This produced 3 measures per edge, or 12 measures in all. These numbers were then averaged to give a mean convergence error from beam to beam. The lower the number, the better the alignment of the three beams.

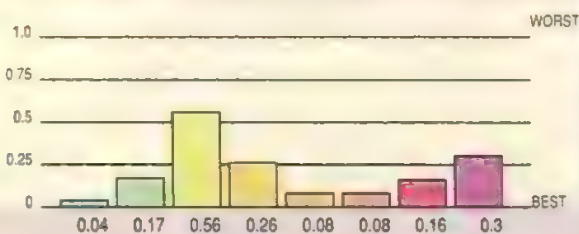
Brightness

(footcandles)



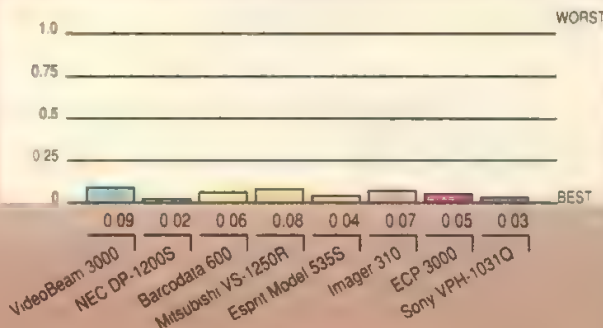
Keystoning

(inches)



Convergence Error

(inches)



CONTINUES

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COMPOSITE VIEW: DATA PROJECTORS

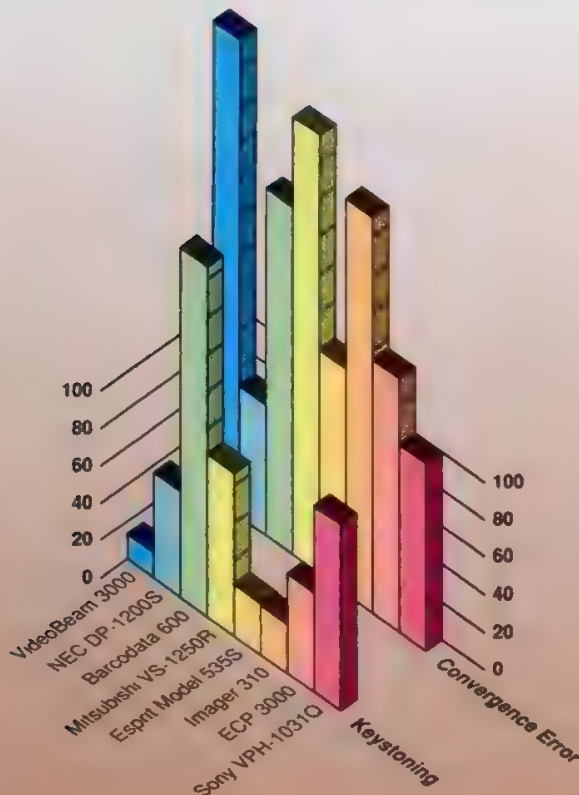
Data projectors all use essentially the same technology to produce an image and project it onto a screen. Consequently, you might expect to find nearly identical results for the benchmark tests. But this is not the case.

An important insight into the test results is revealed by the variation in measurements between the identical GE and NEC projectors. The variation can be attributed more to the taste and skill of the vendors' technicians invited to set up the system than to any substantive technical difference in the systems' designs.

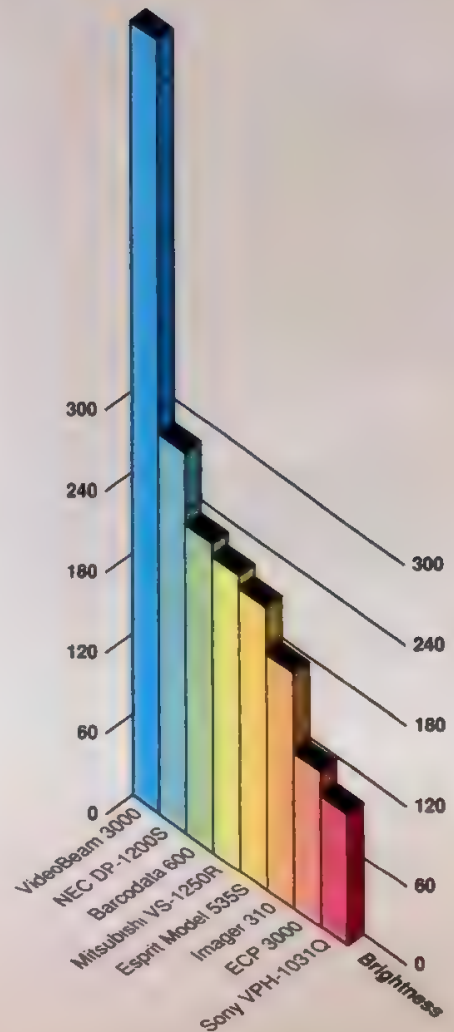
In all cases, the brightness results are really subject to the whims of the technician. As you increase brightness, the projected dot size grows significantly, so a brighter image tends to be fuzzier. Setting the projector for the best image possible depends on whether the installer considers the best image to be brighter but fuzzier, or dimmer but sharper. The convergence and keystoneing measures are done by eye for the most part; given sufficient time, it would appear that just about any of these units should be capable of near perfect results.

With that in mind, the distinguishing factors really are to be found in areas such as dealer skill and support and projector features and capabilities.

(A word must be said here about AmPro Corp.'s VideoBeam 3000. A fixed-focus model, it could not be adjusted to produce the required 7-foot wide image. Its image was roughly one-half the surface area of those produced by the others, so its light was concentrated in a smaller area. While we cannot interpret the difference precisely, it would appear that the AmPro is roughly equivalent in brightness to the rest of the units.)



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(Taller bars represent better performance)

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HARDWARE

DATA PROJECTORS

FACT FILE

Sony VPH-1031Q

Sony Communications Products Co., 1600 Queen Anne Rd., Teaneck, NJ 07666; (201) 833-5200.

List Price: Projector, spacing shims for use with 72-inch and 200-inch screens, \$8,575.

Options: Ceiling mount, \$275; carrying case with wheels, \$600; remote control, \$600; floor-mount pedestal, \$610; 33-foot remote to projector cables, \$200; 82-foot, \$375; 165-foot, \$695.

In Short: With an extremely competitive price and an excellent picture, the Sony VPH-1031Q is one of the top attractions in its class. If it only had digital convergence and a bundled remote control, it would be unbeatable.

CIRCLE 403 ON READER SERVICE CARD.

including a \$600 infrared remote control, a carrying case that also sells for \$600, and screens that range in price from \$690 for a 100-inch flat-screen model to \$5,000 for a 72-inch rear-screen unit. With these and various third-party options, you should be able to assemble a system that meets most requirements.

The VPH-1031Q does not use digital alignment, but instead relies on the physical adjustment of the potentiometers that are within the projector's case to converge the beams. Of course, digital convergence is more convenient, especially when the projector is mounted in an awkward location. The VPH-1031Q uses circuitry to adjust to changing signal frequencies, so there is only one alignment setting to store.

MORE POWERFUL THAN IT SEEMS

A look at the projector's specifications might lead you to believe that it is not as powerful or flexible as some of the others. Some vendors claim much higher brightness measures and video signal bandwidths; others offer greater horizontal scan

frequencies and pixel resolutions. For instance, Sony claims a brightness measure of only 300 lumens, while other companies boast 600 lumens or more for nearly identical technology.

The truth seems to be that Sony is simply conservative in its rating of the VPH-1031Q. After all, it is Sony that makes the CRTs that are used in most of the competing designs; there cannot be a 100 percent variation in brightness among these models.

And in fact, the VPH-1031Q projects incredibly crisp and clean images. The black text on white background was good, and graphics images were outstanding. The Sony had nearly the best convergence measurements of all the units tested (of course, technician skill makes a lot of difference in these measurements). While the Sony was the dimmest of all, that helped make the image sharper.

Even taking the dimness factor into consideration, the projector's output left a strongly favorable impression. These impressive results show that when it comes to making your buying decision, you should not hold Sony's conservative specifications against this system.

The VPH-1031Q stands out in two respects: it produces the most impressive display of all the projectors we saw, and it is available at a low price, particularly if you don't need any of the extra-cost options. But even if you do need add-on items, the Sony still winds up with a lower price than most of the other systems reviewed here. Digital convergence controls and an infrared remote (standard with the list price) would certainly add to the product's winning qualities, but even without these, it remains one of the most attractive options in the group.

Extra options like remote control, carrying case, and rear-screen configuration can add thousands to the base price of the Sony VPH-1031Q. But that base price is certainly a low one: \$8,575—more than 40 percent less than the \$15,000 ceiling for this project.



EDITOR'S CHOICE

Too Close to Call

With the exception of the VideoBeam 3000, PC Labs' performance test results indicate that the data projectors reviewed perform more or less the same. Some had noticeably better images—namely the Sony VPH-1031Q and the Esprit Model 535S—but others had better features and bundled items. As a result, none emerges as a clear winner.

Overall, the skill of the installer and the support your dealer provides are probably more important than any of the performance differences we saw. If we could assume that you would get the same level of skill from any dealer, we expect little difference among most of these units.

Honorable mentions go to Sony, NEC, and General Electric for offering the best combinations of performance and features for the money. Sony has an edge with image quality and the lowest list price of all, but it loses some ground with its paucity of features and lack of digital convergence. NEC includes a few more doodads than GE for about the same price (for the same unit). Both, however, are good values in spite of images that were not quite as sharp as some of the others.

Alfred Poor is a contributing editor of PC Magazine and industry analyst who does much of his work in an electronic cottage located in Perkasio, Pennsylvania.

As we went to press, a number of data projector manufacturers lowered their prices. Here are the new prices for the machines in this review: Ampro's VideoBeam 3000, \$8,995 (reduced \$305); Barco's Barcodata 600, \$11,995 (reduced \$2,000); Electrohme Limited's ECP 3000, \$14,400 (no change); General Electric's Imager 310, \$9,750 (reduced \$1,647); NEC Technologies' DP-1200S, \$11,300 (no change); Gretag Image Systems' Esprit Model 535S, \$11,495 (no change); Mitsubishi Electric Sales America's VS-1250R, \$14,300 (no change); and Sony Communications Product Co.'s VPH-1031Q, \$8,575 (no change).

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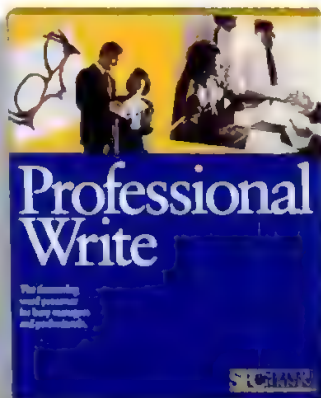
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CIRCLE 145 ON READER SERVICE CARD

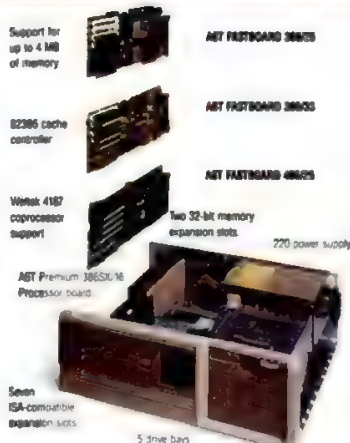
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Type	16 MHz	16 MHz	12 MHz	16 MHz
Speed	16 MHz	16 MHz	12 MHz	16 MHz
Available Slots	5	4	4	3
EMS Support	4.0	3.2	4.0	No
Software Included	4.0	3.2	4.0	No
Landmark Benchmarks*	20.1	15.4	11.0	15.3
List Price** One-Floppy System	\$2,999	\$3,299	\$2,999	\$3,999***

* Landmark Software version 1.1 benchmarks — a generalized index used to compare one machine to another. The higher the number, the better.

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CIRCLE 166 ON READER SERVICE CARD

HOLD IT!

Screen-Capture Software Saves the Moment

There's more to saving screens to disk than just hitting a hotkey, as *Collage Plus*, *The Graphics Link Plus*, *HiJaak Plus*, *Hot Shot Graphics*, and *Pizazz Plus* demonstrate.



by Robin Raskin

Sometimes Shift-PrtSc isn't enough when you want to get an image from your screen onto paper. With screen-capture utilities, you can take a snapshot of what's on-screen and then transfer it to a DTP or other program, collect multiple images and play them back later as a screen show, or tweak and print the images.

In this article, PC Labs tests five TSR (terminate-and-stay-resident) utilities that handle screen captures: *Collage Plus*, *The Graphics Link Plus*, *HiJaak Plus*, *Hot Shot Graphics*, and *Pizazz Plus*.

Why use screen-capture software in the first place? Here are five good reasons:

■ **Computer documentation.** Two-thirds of screen captures wind up in reference manuals and other printed documents, according to a survey by Inset Systems. If you want to include the entire screen—borders, menus, prompts—a screen grabber is your best choice.

■ **Slide shows or demos.** A good presentation graphics program will provide slide-show capability, but usually for the program's own images only. With screen grabbers, you can capture images from different programs and batch them together into an on-screen presentation. (You can also use batch mode to either print to paper or convert groups of images.)

■ **Nonstandard file formats.** If you want to move an image from one application to another, try to import the image directly or convert among file formats. Screen capture limits you to the size and resolution of the screen; file importation and conversion are resolution-independent and not limited to the size of the image on-screen. But when you work with custom applications or less-standard formats, such as those of *Show Partner* or *AutoCAD*, you'll depend on screen capture. *The Graphics Link Plus* and *HiJaak Plus* provide more-extensive conversion routines than *Collage Plus*, *Hot Shot Graphics*, or *Pizazz Plus*.

■ **Color printing.** If your program sends color to the screen better than to a printer, you can capture the image and use the utility's print-enhancement routines.

■ **Image editing.** After you capture a screen, you can size, annotate (with text, lines, and arrows), and box the image. You may also be able to rotate the image, alter it pixel by pixel, modify the colors, or translate the colors to gray-scale images for black-and-white printing.

BEST WITH STANDARD VIDEO

Screen capture has become fairly reliable with CGA, EGA, and VGA displays that produce 16 colors. Problems can arise with Super VGA (800 by 600 resolution) displays, 320 by 200 by 256-color .GIF images, and TIFF images that come in compressed or uncompressed and in black and white, gray scales, or color.

The five programs we review represent the image-capture mainstream, but there are other image-capture choices, too. On CompuServe, you'll find an array of free or low-cost capture and conversion programs on the Graphics Support, Adobe, and IBM forums.

Many software packages include their own screen-capture utilities. *ColorRIX*, a VGA paint program, has a capable screen grabber, as does *Dr. Halo*. FRIEZE, *PC Paintbrush IV*'s resident capture program, is widely used. Those who build their own graphics applications should look at the *PCX ToolKit* library of graphics utilities, which includes capture. For *Microsoft Windows* users, there's *DoDot* from Halcyon Software (Cupertino, California). If you want to capture Presentation Manager screens, get PMCAP.ARC on PC Mag-Net's Programming forum on CompuServe. Targa board users should try

PHIPS, a Targa conversion program from HSC Software, maker of *The Graphics Link Plus*.

MicroPro, Microsoft, WordPerfect, and Lotus all include screen-capture facilities for use with their word processing programs. Some screen-capture programs are linked to service bureaus that can produce 35mm slides, transparencies, or four-color separations. The best-known of those programs is *PixelPop* from StudioCraft and ImageSet.

Among mainstream image-capture programs, there's plenty of room for growth. Over the next year, look for support of higher-resolution screen images, vector formats, 16-million-color capture, and better image management.

Collage Plus

If your screen-capture jobs are limited to preparing .PCX and TIFF files, you'll like Inner Media's \$89.95 *Collage Plus*. You can preview images before you capture them and save them directly in either TIFF or .PCX format.

You can run the resident Image Capture, View, and Save modules together via the SNAP program; SNAP normally takes up 44K but will use only 17K if you work with LIM 4.0 memory. You can also run each module separately.

The capture is invoked using the Shift-PrtSc hotkey; a pop-up menu offers the option to save the screen as a text, TIFF, or .PCX file. TIFF and .PCX screens can be saved as color or monochrome or in various gray scales.

Collage supports three different dithered gray-scale conversions, as well as a TIFF True Gray scale. Even though the gray-scale TIFF images created using *Collage* contain only 16 levels of gray, they look photographically real on a VGA screen. Brought into *PageMaker* and printed on a PostScript printer, they offer smooth, uniform tones. However, the dithered images are not as attractive as those created with *The Graphics Link Plus*, which offers more output-specific dithering algorithms.

Once you select the capture format, *Collage*'s resident viewer pops up to let you preview the results. In theory, the viewer tests the advisability of an intended capture format, but in practice the proce-

dures is a disappointment. Since the viewer offers only a tiny black-and-white pop-up box with one zoom level, what you see is a poor indication of what you'll actually get. To view color and full-page layouts and to use a variable-level zoom, you must leave the RAM-resident mode and access *SHOW*, *Collage*'s nonresident image manager and viewer.

With the exception of ASCII text screens, you cannot print from *Collage*. There are no facilities for editing, sizing, rotating, or cropping images. The only real image manipulation available is the ability to modify and reset a color palette with a simple on-screen color map.

The *Collage Plus* program fully supports 256-color capture and viewing. It additionally captures and displays Super VGA's 800 by 600 mode.

File maintenance is one of *Collage*'s stronger points. You can delete, rename, and maintain files without leaving your application. Other features include slide shows and the ability to access many display options from the command line.

Collage Plus won't knock your socks off, but if you want to get cheap and quick .PCX and TIFF images, it provides the necessary tools.

Collage Plus, Version 3.0. Inner Media Inc., 60 Plain Rd., Hollis, NH 03049; (603) 465-3216. **List Price:** \$89.95; OS/2 version, \$199; upgrade disk for viewing 256-color images, \$15. **Requires:** 17K RAM, DOS 2.0 or later.

CIRCLE 428 ON READER SERVICE CARD

The Graphics Link Plus

HSC Software's \$149 *The Graphics Link Plus* (TGL+) is primarily a file-conversion package, but the company tosses in two full-bodied screen-capture utilities (one for *Microsoft Windows* and one for DOS) for good measure.

All captured screens are saved in .PIC format, which is also used by *PC Paint* and by *Grasp*, a popular animation program. The *Windows* program lets you crop the window before grabbing it, a welcome feature for graphic artists, who often don't want to show a full window. The DOS screen capture is no-frills—without editing, sizing, annotating, or colorizing options. About all you can do is specify a custom name for the file.

Robin Raskin is a contributing editor of PC Magazine.

SCREEN PLAY



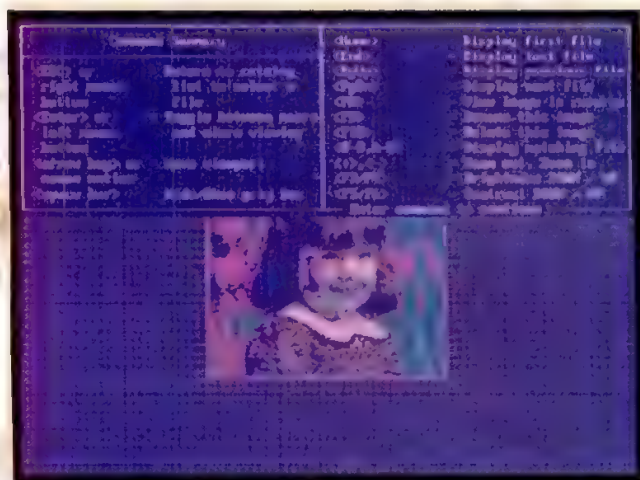
A2: 78978978

	A	B
1	Enter the number	
2	78978978	
3	8887.011	8887.011
4	8887.011	8887.011
5	8887.011	8887.011
6	8887.011	8887.011
7	8887.011	8887.011
8	8887.011	8887.011
9	8887.011	8887.011
10	8887.011	8887.011
11	8887.011	8887.011
12	8887.011	8887.011

Capturing text screens such as this Lotus 1-2-3 worksheet at screen resolution makes for jagged-looking printouts. With *HiJaak Plus*, you can convert a captured .PIX file to a .PCL file by substituting a 300-dot-per-inch font. The result is better-than-screen-resolution screen capture when you output to the HP LaserJet.



King Tut began as a .GIF file (320 by 200 by 256 colors). Once captured by *Pizazz Plus*, the printed output is optimized for the HP PaintJet. You are able to tweak and tune the display screen colors, size, and page placement to get the perfect printout. The program supports 303 different printers.



Collage Plus's screen capture stores a graphical image in one of 19 different TIFF or .PCX formats. When saved as a true gray-scale TIFF, the image has a photo-like continuous-tone effect. *Collage* offers no sizing, editing, or printing tools. This file was brought into *PageMaker* and printed on an HP LaserJet.



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GRAPHICS

SCREEN-CAPTURE SOFTWARE

The program supports 256-color capture, even in 320 by 200 mode. You can grab Super VGA images in 800 by 600 resolution if you have an adapter that uses the Tseng chip set or a Paradise video board. At 34K, this program is even small enough

Many of The Graphics Link Plus's submenus allow fine-tuning for file format quirks and version incompatibilities.

to grab screens from memory-hogging applications like *Lotus Freelance Plus*, Version 3.0.

You can also capture any ASCII text file, even one larger than a screen. An ASCII file can be converted to a .PCX bitmap; any of the eight fonts included on-disk can be substituted for the screen text. Images larger than screen size can be rotated using the ROTATE utility.

In contrast to the virtually nonexistent capture-module interfaces, a well-designed user interface invigorates the conversion portion. Captured images can be displayed, sized, and converted to other formats. In addition to the standard .PCX, TIFF, .MSP, .WPG, and .GIF conversions, the program supports a number of specialty conversions, among them .RIX, *Lotus Manuscript's* .BIT, *PFS:First Publisher's* .GSI, and *Show Partner's* .GSI. Many of the conversion routines, most notably TIFF and .RIX, have submenus that allow fine-tuning and adjusting for file format quirks and version incompatibilities.

TGL+ also performs a one-way conversion from a black-and-white source file to a black-and-white .EPS file, but unlike *HiJaak*, it does not include a bitmap TIFF image along with the .EPS file. In addition, the program doesn't support vector-based conversions to PCL or HPGL.

TGL+ handles gray-scale conversions more scientifically than most other packages. You get 11 dithering algorithms to choose from, along with a few pointers on how to optimize the patterns for various output devices. A handy automatic trace

feature turns a color bitmap into a closed-shape monochrome bitmap.

The image-scaling facilities give users another precision tool. The work screen lets you manually enter new values to change the size of an image, but it also allows you to enter a new dot-per-inch setting (up to 2,450, which is typeset quality) to see how this affects the size. Also included is a powerful keystroke-recording macro function; with this, you can create impressive batch processes.

TGL+'s viewer is slow. It treats the screen view as though it were decompressing and converting the file. The program includes a slide show mode with an option to specify timing intervals. But in order to optimize the slide show for speed, you must convert all images to .RIX (the only decompressed file format), an added nuisance. Printer support is limited but adequate, with drivers for the Epson FX-80, the HP LaserJet Plus, and PostScript devices.

The program could do with some re-vamping in the documentation arena. Some of the instructions are poorly written, and you only get on-disk documentation for the capture modules.

On the positive side, HSC Software provides a helpful bulletin board ((404) 769-4171) that makes extra fonts and graphics utilities available. If a variety of conversion options, precise scaling facilities, and powerful macros are important to you, *The Graphics Link Plus* can be a valuable investment.

The Graphics Link Plus, Version 2.00a. HSC Software, 1661 Lincoln Blvd., #101, Santa Monica, CA 90404; (213) 392-8441. **List Price:** \$149. **Requires:** 512K RAM, DOS 3.1 or later.

CIRCLE 429 ON READER SERVICE CARD

HiJaak Plus

HiJaak is a versatile screen-capture and conversion program but lacks preview and editing capabilities, whereas *Inset*, one of the first PC solutions for integrating graphics and text, is endowed with capture, view, and modify options. Bundle them together in a single package and you get Inset Systems' \$199 *HiJaak Plus*.

While the combination has its rewards, you will have to deal with the fact that the two programs don't share a common user

interface. *HiJaak* can be run from the command line or through a simple shell menu; *Inset* pops up with a two-line command menu at the bottom of your screen.

Both programs are easily installed and configured, and both let you assign customized hotkeys, file storage paths, and a variety of modes in order to minimize RAM-resident conflicts.

HiJaak's RAM-resident capture module automatically saves the screen to its proprietary .PIX format. *Inset's* RAM-resident capture also saves screens in the .PIX format, but not before it invokes a pop-up menu that offers simple screen-editing tools.

Inset lets you size, crop, and draw graphics primitives. For quick and simple screen editing, like framing and annotating text, it can't be beat. You can remap colors and convert color to gray scale, although the interface for these chores isn't as handsome as that of *Pizazz Plus*. *Inset's* preview function also lets you size an image and place it within another application, like a word processor.

Neither of *HiJaak Plus's* capture modules supports any of the 256-color mode captures, and neither could grab a screen from *Lotus Freelance Plus*, Version 3.0, which hogs most of your 640K RAM. You cannot toggle the colors of the pop-up capture menu—I couldn't capture a screen from a Sierra On-Line game because its black border obliterated the menu. EGA screens from applications like *Harvard Graphics* had incorrect color mapping, but *Windows* and 640 by 480 by 16-color screens were easily captured.

HiJaak can intercept information going out to a printer or a plotter and save it as a .PCL or .PGL file; these vector files can be converted to other bitmap formats. The program also converts between vector formats, including HPGL, .PIC, and .EPS (destination only). *HiJaak* is one of the few packages capable of bundling a bitmap TIFF image with the .EPS image so that you see a picture, instead of a gray bounding box, when working with applications like *PageMaker*.

Using *HiJaak*, you can convert text screens to one of two higher-than-screen-resolution fonts (one for 300-dot-per-inch lasers and one for PostScript printers). The company recently added support for Compugraphic, PostScript, and Linotype printers, so you can capture a text screen and print it at ultrahigh resolutions.

The programs' lack of a common interface, their separate documentation—and

GRAPHICS SCREEN-CAPTURE SOFTWARE

SCREEN-CAPTURE SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

All five programs can perform black/white inversions, convert color images to black and white automatically, and change text screens to a graphics format. All support dithering algorithms, and all have slide-show-like facilities that you can use to display screens in sequence. All but one can go beyond the maximum VGA resolution of 640 by 480 pixels, although not all of them support the full 256 colors of the VGA standard.

	Collage Plus \$89.95	The Graphics Link Plus \$149.00	Pizzazz Plus \$149.00	HiJask Plus \$199.00	Hot Shot Graphics \$249.00
ENVIRONMENTS AND FORMATS					
Native file size of sample image (bytes)	15,614 (color .PCX)	11,603	18,349 (with VGA and color printer installed)	19,479	14,338
Amount of RAM required by DOS screen-capture program	44K (17K with EMS)	34K	32K	45K	23K
Uses LIM EMS 4.0	■	□	□	□	■
Uses extended memory	■	□	□	□	□
CONVERSION FORMATS					
Accepts/converts to:					
.EPS	□/□	□/■	□/■	□/■	□/■
.GIF	□/□	■/■	□/□	■/■	■/□
.IMG (GEM)	□/□	■/■	□/□	■/■	■/■
.MAC	□/□	■/■	□/□	■/■	□/□
.MSP (Microsoft Paint)	□/□	■/■	□/□	■/■	■/■
.PCL	□/□	□/□	□/□	■/■	□/□
.PCX (color)	■/■	■/■	□/■	■/■	■/■
.PCX (gray-scaled)	■/■	■/■	□/■	■/■	■/■
.PCX (monochrome)	■/■	■/■	□/■	■/■	■/■
.PIC	□/□	■/■	□/□	■/■	□/□
.PNT (gray-scaled MacPaint)	□/□	■/■	□/□	■/■	■/■
.PNT (MacPaint)	□/□	■/■	□/□	■/■	■/■
.TIFF	■/■	■/■	□/■	□/■	■/■
.WPG (WordPerfect)	□/□	■/■	□/■	■/■	■/■
Other formats	TIFF True Gray, .TXT	Dr. Halo, Lotus Manuscript, PFS:First Publisher, .RIX, Show Partner	ASCII, Microsoft Word .IMG, TIFF Color, Splash, Expanded .PCX for Ventura	Amiga, Dr. Halo, fax CCITT, HPGL plotter files, Inset, .PIX, .TXT	None
CAPTURE CAPABILITIES					
Standard capture file format	TIFF, .PCX	.PIC (Pictor)	Proprietary	Proprietary	Proprietary
Screen-capture program can be removed without reboot	■	■	■	■	■
Captures 256 colors	□	■	■	□	□
Captures Microsoft Windows screens	■	■	■	■	■
Highest-resolution capture (horizontal x vertical x colors)	800 x 600 x 16*	1,024 x 768 x 16, or 800 x 600 x 256	1,024 x 768 x 16, or 512 x 512 x 16 million	640 x 480 x 16	800 x 600 x 16
EDITING CAPABILITIES					
Number of preset scaling sizes	N/A	None	None	6	3
Infinite scaling sizes	□	■	■	■	■
Zoom	■	□	□	■	■
Rotate	□	■	■	■	□
Paint facility or pixel editor	□	□	□	■	■
PRESENTATION CAPABILITIES					
Borders around screens	□	□	□	■	■
Titles or captions	□	□	□	■	■
Prints at 300 dots per inch	□	■	■	■	■
Batch-printing facility	□	■	■	■	■
Option to print or not print cursors	■	□	■	□	■

■—Editor's Choice ■—Yes □—No N/A—Not applicable: the product does not scale images

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GRAPHICS SCREEN-CAPTURE SOFTWARE

the need to grapple with two learning curves—can be annoying. *HiJaak*, Version 2.0, which will be available shortly, will combine a revamped user interface with support for a new genre of vector file-format conversions. Until that product debuts, you can depend on *HiJaak Plus* to accomplish many of your chores, but be prepared to face some challenges.

HiJaak Plus, Inset Systems Inc., 71 Commerce Dr., Brookfield, CT 06804; (800) 828-8088, (203) 775-5866. **List Price:** \$199. **Requires:** 512K RAM, DOS 2.0 or later.

CIRCLE 542 ON READER SERVICE CARD

Hot Shot Graphics

Symsoft's \$249 *Hot Shot Graphics* is the Swiss Army knife of screen-grab programs, combining capture, pixel-based graphics editing, and image conversion and cataloging utilities in one tightly integrated package. If your application demands any sort of pixel-level control of the captured screen (and you don't want to bother importing images into a paint program), *Hot Shot* is the right choice.

Hot Shot is really a trio of programs. GRAB.EXE is the resident capture facility for DOS graphics and text screens; WIN-GRAB.EXE runs under *Windows* to capture *Windows* screens; a standalone program, HSG.EXE, handles all viewing, text and graphics screen editing, cataloging, and image printing and conversion.

Both of the capture programs are RAM-resident (each uses about 25K); graphical images are captured and stored in a proprietary format. The DOS capture program incorporates a handy auto-incrementing feature that lets you grab a series of images as it automatically assigns filenames. A toggle key lets you cycle through colors on the program's pop-up menu in the event that you have a color clash between the menu and your screen.

Hot Shot captures color-palette information accurately from both *Windows* and non-*Windows* VGA screens, but not from all EGA applications. Version 1.7 can also capture both OS/2 and PM screens, and individual portions of *Windows* screens. At present, *Hot Shot* does not support the capture of 256 on-screen colors.

Hot Shot's greatest strength lies in the post-capture process. Text and graphics

screens can be displayed and fine-tuned with its full-featured editing tools, which are accessed via pull-down menus and a graphics toolbox.

Text screens can be annotated with symbols, lines, or text. You can cut and paste blocks and include shaded and highlighted regions. Text screens can be printed with attractive borders and titles. Laser-printed text screens look great when *Hot Shot's* 300-dot-per-inch font is substituted for that of the captured image.

You can clean a scanned image on a pixel-by-pixel basis. You can also size, crop, and rotate the picture, create composite images from multiple files, cut-and-paste blocks, and add text and graphics primitives. The eight-level zoom and the pan tool make moving around larger-than-screen-size images easy.

Occasionally, *Hot Shot* makes you do things the hard way. When you want to access the complete color palette to recolor an image, first you must create a new empty file and read your existing file into it.

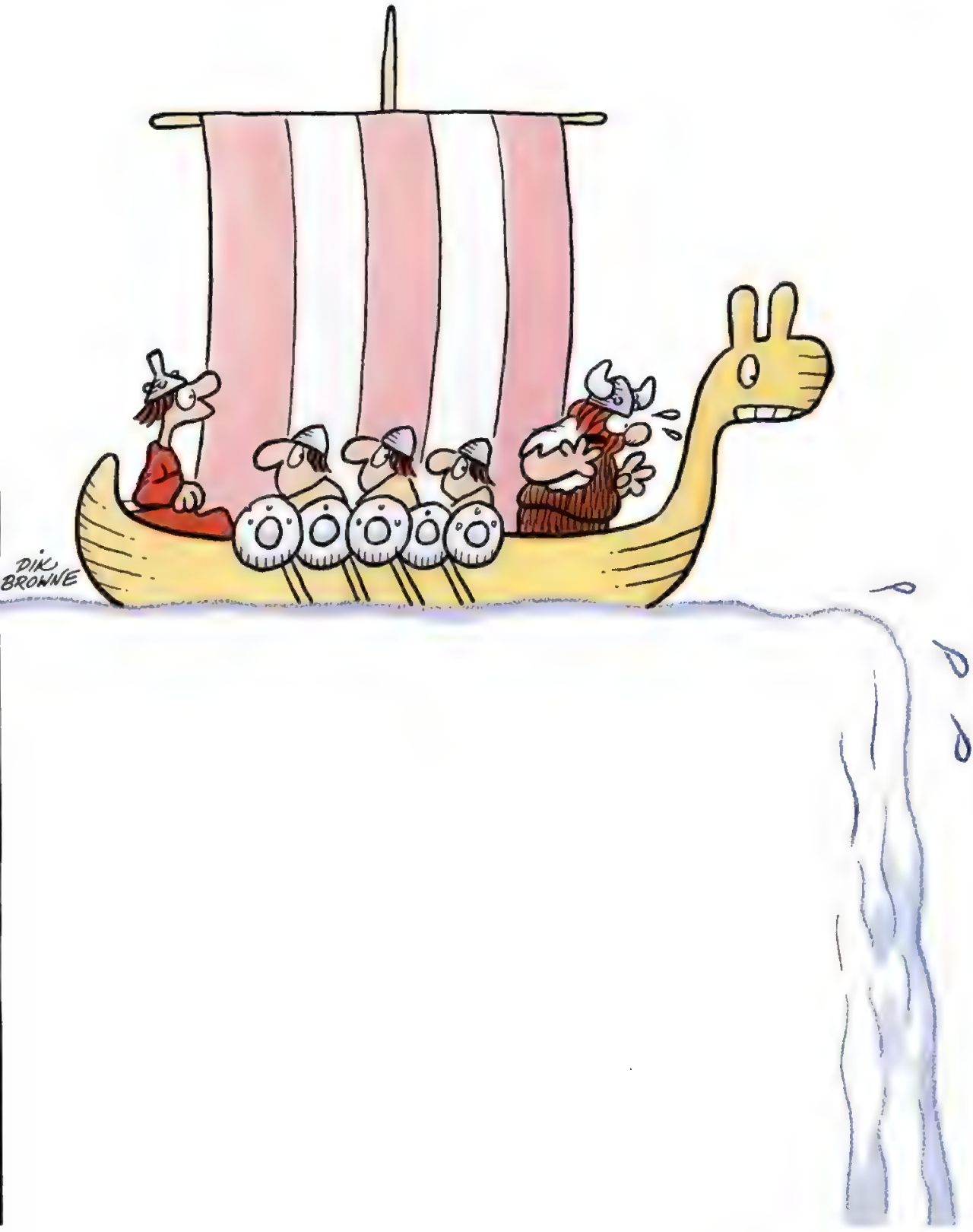
The process of converting color to gray scale works reasonably well but lacks the

*Hot Shot captures
color-palette
information accurately
from Windows and
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all EGA applications.
Version 1.7 can
also capture both OS/2
and PM screens.*

tweakability of programs with more shading alternatives. Colors are automatically mapped to eight shades of gray, plus black and white.

Those who get snowed under with images will appreciate *Hot Shot's* simple but elegant cataloging feature. You create a catalog, add pictures to it, and sort by filename, date, or title. The catalog's contents

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GRAPHICS SCREEN-CAPTURE SOFTWARE

can be transformed into a batch printing job or an on-screen slide presentation. The slide presentations can even have user-specified timing intervals.

Hot Shot offers a fascinating array of post-capture processes, and the inclusion of many tools found in full-bodied paint programs is particularly welcome. While some options would benefit from improvement, this is basically a fine product.

EDITOR'S CHOICE

Hot Shot Graphics, Version 1.5. Symsoft Inc., 444 First St., Los Altos, CA 94022; (800) 344-0160, (415) 941-1552. **List Price:** \$249; upgrade to Version 1.7, \$75. **Requires:** 512K RAM, hard disk, DOS 2.1 or later.

CIRCLE 543 ON READER SERVICE CARD

Pizazz Plus

If the handsome images on your screen fall flat when output to your favorite printer, you need Application Techniques' *Pizazz Plus* (\$149). The program fine-tunes captured screens for output to any of 303 directly supported printers. Except for the slight inconvenience of having to renavigate the installation whenever you change printers, *Pizazz* makes outputting screens a painless adventure.

Pizazz's user interface is clear and consistent. The memory-resident capture portion of the program can be installed in either resident or overlay operation; in the latter mode, using a VGA display and LaserJet printer, it occupies about 30K.

Before you print or save your on-screen image, you access *Pizazz's* menu to optimize your capture for hard copy. You can smooth, crop, or rotate the image and specify its positioning on the printed page. But the real printing strength of *Pizazz* is its ability to size an image precisely and print it in various color or gray-scale styles, based upon your output device.

As you size an image, the program references the resolution of your printer, as well as your intended print style. You can size images manually by entering their dimensions in inches, or you can let the program take control. The helpful Round Up/Round Down option increases or decreases image width and height to the next 1:1 screen ratio.

GRAPHICS
SCREEN-CAPTURE SOFTWARE

Pizazz's Style and Shading menus offer choices appropriate to your output device; you can select Color or Black and White in Presentation, Standard, or Draft printing. Halftone printing is available for high-resolution devices and makes output from scanned photos look terrific.

For color adjustment or gray-scale mapping, users with a VGA board can control 256 continuous colors or 64 shades of gray. With image-capture boards like the Targa, you access up to 16 million colors and 256 gray levels. With 16-color images, a concise color map lets you reassign colors. With 256-color images, you work in true interactive fashion, brightening, darkening, and remapping shades.

An alternative to mapping each color is the Assignment option. *Pizazz* uses four different algorithms to assign colors or grays globally in an ordered, relative, absolute, or fixed manner. *Pizazz* takes its best guess (usually a good one) at how you want your color captured, but its preview and modify options give you tremendous control over hard-copy color and shading.

Because *Pizazz* is installed for a specific output device, the more powerful that device, the more sophisticated your shading



EDITOR'S CHOICE

- Hot Shot Graphics
- Pizazz Plus

All of the screen-capture programs that we reviewed in this roundup handle screen capture and a whole lot more. But two of the programs, *Hot Shot Graphics* and *Pizazz Plus*, are genuinely outstanding, each in its own way.

If you need to modify a captured screen by adding a caption, an arrow, or a simple graphic, or if you want to get in at the pixel level for fine-tuning, you'll find *Hot Shot Graphics* at the top of your list. But *Pizazz Plus* is the clear winner if you want to optimize a captured image for printed output. *Pizazz Plus* supports over 300 different printers; lets you tweak size, rotation, and image positioning; and quite simply, offers the most sophisticated screen-to-printer color mapping available.

ing options. Even with the most complex device, tweaking and tuning is easy and fast. Because you test and modify your output within *Pizazz* prior to exporting it to another application, you save time.

Screen images can be printed or saved to .EPS, .PCX, TIFF, or .PZI (*Pizazz's* native format) files. File-conversion support is adequate and improving. The newest release supports TIFF Gray, TIFF Color, and .PCX in 16 and 256 colors.

A full-screen, nonresident image viewer is unimpressive but functional. The company includes a special *Windows* grab utility, and batch printing is also available.

Pizazz can't work with virtual pages larger than the screen, nor does it let you annotate or modify a screen image. But for the highest-tech screen dumps available, nothing can beat *Pizazz*.

EDITOR'S CHOICE

Pizazz Plus, Version 1.3. Application Techniques Inc., 10 Lomar Park Dr., Pepperell, MA 01463; (800) 433-5201, (508) 433-5201. List Price: \$149. Requires: 256K RAM, DOS 2.0 or later.

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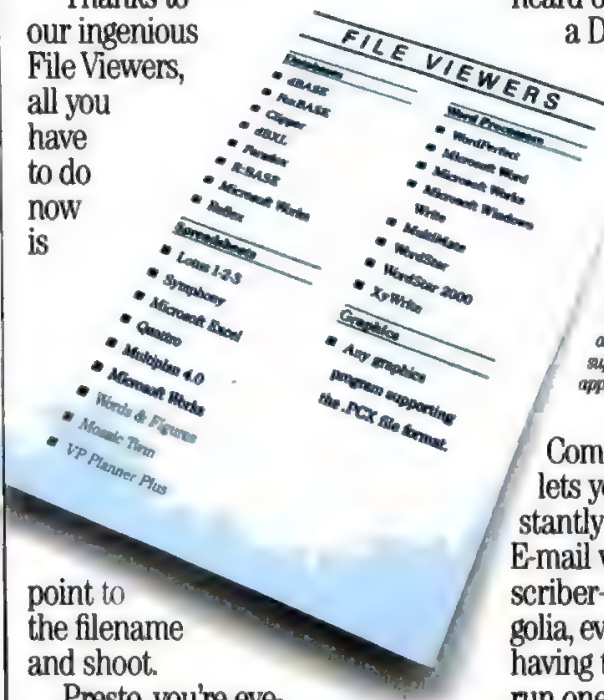
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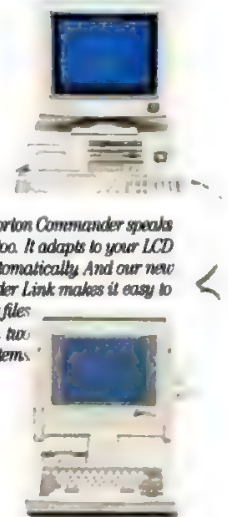
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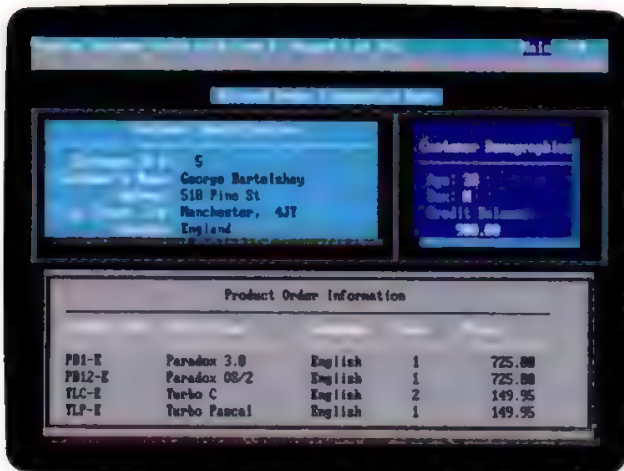
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B O R L A N D

edited by
Trudy Neuhaus

Databases

In the previous issue, Craig Stark introduced a new column to the Productivity lineup: The Working Word. In his introduction Craig explained that it replaces Power User and is strictly devoted to word processing.

There is a second part to that announcement: For all of you who read Power User for the database tips, you haven't been forgotten. In fact, Databases is a column that has been created just for you. Devoting a column strictly to databases allows us to take an in-depth look at applications and add-ins that space and format previously prohibited.

Yet apps and add-ins do not a column make—at least not in Productivity. We will also investigate current database issues and ways to make you more efficient when working with databases. After all, *that's* what Productivity is all about. But to do this requires something else. Feedback. I need to hear from you: what products you want to explore, what topics you want to tackle, and what problems you need to solve. I'm especially interested in hearing about useful tricks and techniques you've learned or uncovered. From time to time I will publish the best of what our readers have to offer in these pages. But *everyone's* contribution will affect the editorial course this column pursues.

While tips and techniques make you more productive at a local level, they can go only so far. If you have written a useful utility in MASM, for example, that can be linked to *dBASE*, this is the place for you to be heard. Likewise, we will also be exploring more-global issues such as which language is best to use. For example, both *Clipper* and *FoxPro* have provided enhancements to their languages that make them incompatible with *dBASE*. Which should you choose? When should you switch? Stay tuned: this is one topic we will visit in depth in upcoming issues.

Another important topic is choosing between high-level languages (HLL) and the database languages—which is our focus in this issue and in the next several columns.

My goal in this column is twofold.

Short-term Efficiency, Long-term Productivity For Database Users

■ Though Power User is gone, databases are far from forgotten. In this issue, our newest column investigates the relative merits of high-level languages and database languages.

First, I want to give you a handle on short-term increases in productivity through tips and techniques. And second, but perhaps more important, I am also keenly interested in covering the subjects necessary to long-term, long-range productivity improvements.

DATABASE VS. HIGH-LEVEL LANGUAGES

With the relatively recent introduction of HLL database libraries, such as Borland's *Paradox Engine*, it's fast becoming easier and easier to create complex database applications using HLLs either in place of or in combination with *dBASE*-type languages. So in this issue I'll tackle the question that always arises whenever we're given an alternative: which is better? Using the *dBASE* language and C as examples, let's take a look at some of the pros and cons of using each.

dBASE FOR THE NOVICE

If you're a novice programmer, you should seriously consider using *dBASE*. It's one of the best "first" languages for beginners, mainly because it encourages structured programming. Its modularity

and relatively simple yet powerful structure make it easier to write clean code quickly. As you would expect, *dBASE* also has more built-in database capabilities—features generally lacking in C and other HLLs. But perhaps most important to a beginner are its memory-handling capabilities and interpreted language; as we'll see next, they are constructed so that you won't experience a serious crash of *dBASE* or your computer, and you can always return to the dot prompt no matter how bad your errors are.

MEMORY HANDLING

C and other HLLs have the capability of accessing and then writing over any part of memory. *dBASE*, on the other hand, addresses only the memory variables it creates. By managing its applications' memory variables, *dBASE* provides a big layer of protection between the program and the objects the program addresses. In addition, there are no pointers in *dBASE* as there are in C: one variable cannot hold the address of another variable where the address is used to access the latter variable. So the mistakes of a novice are apt to be minor.

Like everything else, however, being once more removed from memory has its advantages and disadvantages. While it's generally safer to program using *dBASE* and its clones, this also means you have little or no control over the overhead used by the DBMS, whether memory or disk space. A good example of this is the end-user support: while the user interface of *dBASE* and its clones is a very attractive feature, it consumes a lot of memory and

Databases

disk space, and it adds overhead to the entire system. But without using an HLL, there's very little you can do to optimize the interface.

THE dBASE LANGUAGE

When you consider all of the steps that a single *dBASE* command encapsulates (including updating and reordering indexes), the value of a DBMS language becomes obvious. In *dBASE IV*, for example, issue the command

USE contacts

where *contacts* is the name of the database file, and *dBASE IV* will automatically open the database file, read the database structure of the file as well as the statistics recorded in the file header (number of records, last update, and so on), open any related multiple index (MDX) file, determine which record is the first in MDX order, and read that record into an internal buffer. Depending on which database library or engine you use, each of these operations may require many lines of C code to implement.

DBMS languages hide many of the file-handling details inherent in database systems from the application, including the underlying database and index file formats. And for the most part, the application does not need to know the file formats, nor does it need to know how to access them. This is the single greatest advantage of DBMS languages. But you pay a price for this.

Inevitably, some day some application will need to know how the database files are managed. Then what do you do? There's no facility in the *dBASE* language for going around *dBASE*. And anyway, a *dBASE* application can only read, write, and update *dBASE* files. It can use *dBASE*'s import and export facilities to move data from one file format to another. But it can only access the formats it supports (text and comma-delimited formats, for example) and cannot read these formats directly. Ultimately, you'll have to custom-write a program in C or some other high-level language in order to access the database data.

Another disadvantage to programming in *dBASE* is that since you can't get very close to the machine—if at all—it's diffi-

cult if not impossible for *dBASE* to access external devices such as serial ports.

dBASE AND NETWORKS

dBASE also hides network communications and network file handling from the application. If it knows the file- and record-locking commands to prevent other applications or users from changing data, an application can access a lot of database information without being aware that the

The value of a DBMS language becomes clear if you consider all of the individual steps, such as updating and reordering indexes, that a single *dBASE* command encapsulates.

database resides on a network.

Unfortunately, it's costly to implement a large application on a large network. Network applications are implemented via LAN packs. Each LAN pack supports a specific number of workstations. The more workstations, the more LAN packs you need. So unless you can find a LAN pack that supports an unlimited number of workstations, the cost can be prohibitive.

PERFORMANCE

Generally there's little you can do to optimize performance in *dBASE*-like systems. A few DBMSs offer "hooks" that let you improve their performance; for example, by setting the number of internal buffers. And, of course, the way in which your application uses the system can affect its performance, too. To create an efficient application, make sure you close files as soon as possible. Also, check which indexes you're using. Are you making *dBASE* search more than it needs to? Keeping more files open than necessary takes up memory that could be put to better use. And making *dBASE* perform unnecessary

searches can slow your machine to a crawl.

But more likely than not, the system is operating at its peak. For although interpreted applications simply cannot run as fast as compiled HLL applications, performance is strictly a factor of the underlying DBMS. This shifts the bulk of the blame for poor performance from the application to the underlying database system—or from the developer to the person who chose the system!

PORTABILITY

The rule here is: if the DBMS is available on the platforms where your application must run, then portability is usually not an issue. You can, for example, port *dBASE* applications to *FoxBASE* and other clones without too much difficulty; you can even port an application between platforms that support *dBASE*.

The level of difficulty of porting an application is in direct proportion to the extent that the application you're porting uses unique features of *dBASE*, or *FoxBASE*, or a particular version of either.

If the DBMS is not on a platform where your application needs to run (such as *Microsoft Windows*, *OS/2*, or *Unix*), too bad. And vendors can't be counted on to release a new version for all platforms simultaneously. For instance, long after *dBASE III Plus* and *dBASE IV* had been released for DOS, the only version available for *Unix* was *dBASE III*.

DEBUGGING

In general, *dBASE* programs are easier to test and debug than those of a high-level language. There's much less that can go wrong. The unique memory-handling features make it almost impossible for a *dBASE* program to crash *dBASE* or its debugger. *dBASE* programs are also easier to debug because the language is inherently an interpreted one. Interpreted languages let you individually test each line of code at the dot prompt—an impossible exercise with HLLs. An interpreted language also means a shorter debugging process. There's no time-consuming edit-compile-link-run cycle, as there is with compiled languages.

dBASE IS ALL YOU NEED

Unlike HLLs, *dBASE* and its clones do not require a compiler or linker. They have built-in facilities for interpreting *dBASE* programs and executing program instructions.

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ASTRONOMY IS LOOKING UP

THE HIRSCH REPORT OF THE SKIES

VOL. 8, NO. 4, FALL 1990

Reported by The Star

Every day billions of dust particles enter into Earth's atmosphere. Now scientists are working to make me-

ter-burst communication a practical and economical alternative to the use of tele-

(continued on page 3)

We Can't See the Great Wall from the Moon!

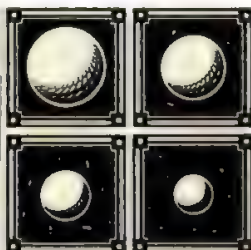
Everyone has heard that you can see the Great Wall of China from the Moon. Or from Earth orbit. Or even from Mars. Certainly you cannot see the Great Wall from the Moon. According to

an astronaut, it's difficult even seeing continents. You may be able to see the Great Wall from orbit, but, in general, it's difficult even to see familiar objects; the planet's swift mo-

(continued on page 3)

Voyager's Last Picture Show

When Voyager 2 was launched 12 years ago, who could have imagined these photos at this point in time.



More on planetary explosions inside

NO BLACK HOLES?

Scientists are still unable to confirm the existence of even a single black hole, despite widespread belief that such things should exist. Tracking down these invisible objects isn't easy, because they can only be studied indirectly by the effects they have on their surroundings. There are several types of places that

(continued on page 3)

MIRROR, MIRROR

It's a chore, but all reflecting telescopes require cleaning their reflective mirrors. Eventually, the aluminum coating on their mirrors deteriorates and needs replacing. For large instruments, the process requires removing the tele-

(continued on page 3)

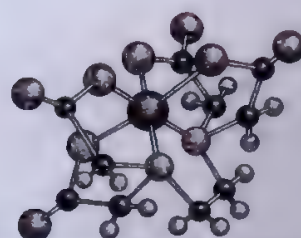
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VOLUME FOUR

ISSUE THREE



New Loops in Metal-Organic Chemistry

Metal-organic chemistry bridges the gap between organic and inorganic chemistry. It can lead to important new products (for example, poison antidotes). A chelate, such as EDTA above (containing carbon, hydrogen, oxygen and nitrogen atoms) can surround ions of metals and remove them from unwanted places. *(continued next page)*

What's New in Superconductivity?

It was almost exactly three years ago that a ceramic material that superconducts above liquid nitrogen temperature was discovered. Within days of the discovery, electronics, power transmission, and transportation were being redefined in everyone's imagination. Yet superconductivity was not a new phenomenon. The effect was first observed in mercury in 1911, and since then, more than 6000 elements, alloys, and compounds have been found to superconduct! *(continued next page)*

Antimatter Bottled

A device tested may give investigators a glimpse of what an antimatter world might look like. The device cools antimatter to a temperature a few degrees above absolute zero and stores it for several days at a time. *(continued next page)*

Fifty Years Ago

Rumor has it that before WWII, our chemists were experimenting with a distilling process to lower the calories of ordinary beer. Abandoning the research at the onset of world war, researchers then pursued the development of a shelf-stable C₆₀. Don't believe all rumors.

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Resolution Enhancement technology shrinks dots to fit in curves and diagonals where they've never gone before.

[illegible]

There is a better way.



Databases

However, this capability also limits what you can do with *dBASE*; if you require a feature that *dBASE* doesn't support, you simply have to wait until a new version supports that feature—or find an alternative. For instance, if the statistical analysis capabilities of a DBMS aren't up to speed, or if the program offers windowing but not a graphical user interface, you're stuck when your application demands these things.

QUICK STARTUP

Interactive front ends, such as that of *dBASE*, lend themselves to quick startups because you don't have to complete a program before users can begin to enter data. Instead, using EDIT and BROWSE commands, users can enter data early in the life of a database.

The nature of the *dBASE* language also allows end users to access and use the database without having to learn any programming skills. With a few simple dot-prompt commands, end users can access a lot of

database information.

Aside from the obvious benefits of quickly getting a usable system in place, this also saves a lot of programming time. When you have people using a system, en-

Enhanced performance
is one great reason
to develop database
applications with HLLs.

tering and accessing data, you'll quickly hear what's wrong (and maybe even what's right) with your program. You'll also know what they like and what they find difficult to use or understand. A smart programmer knows how valuable this information is in the early development stages—not only because it saves programming, testing, and debugging time, but also because heeding users' advice and suggestions as much as possible will go a

long way toward their ultimate acceptance of a given program.

ARCHITECTURAL RESTRICTIONS

The *dBASE* database model was originally conceived over ten years ago; it's based on mainframe technology that was available in 1979. Although the underlying implementations have changed, there are some limits inherent in its structure, particularly when you want to perform relational operations. A fully relational database system would make an application easier to write and maintain. Thus, you might find yourself redesigning your application to fit the DBMS where the latter is simply not flexible enough to do the job required.

HLLS: PROS AND CONS

Increased performance is perhaps the biggest reason to develop applications using an HLL: a database engine application doesn't include the overhead of an interactive end-user interface, and the application code is compiled, not interpreted.

HLLs also give you greater control over an application's use of a library or database engine. However, unless you have the source code, your influence is still limited

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Databases

(although certainly better than with *dBASE*). If the database library or engine source code is available, you can fine-tune the database system for performance purposes. You can also prevent unused database routines from being included in the application unnecessarily, or add overlay capabilities. However, if the code is unavailable, your only alternative is to "roll your own" library.

FLEXIBILITY

After performance, flexibility is perhaps the next reason to consider writing a database application with an HLL combined with a database library or engine. You can do *almost* anything you like and yet still retain enough flexibility to make the database engine *fit* the application.

Creating an application that's database-independent is one example. Using an HLL, you can add a "database-knowable" layer to the application. This layer could make calls to specific engine functions, shielding "knowledge" for the engine from the rest of the application. Thus, future versions of the application would not be tied to any specific database. For instance,

```
open_database();
```

might be a call to a function that would open a *dBASE* database (as in the USE example given above). But to move to another database (*FoxBASE*, for example), just change the `open_database` function and its siblings. The application is never tied to the database, since the function can be altered to use *any* database engine or library.

HLLs allow your application to get closer to the underlying hardware. For instance, if you need to add a facility to download data from a serial port into your database, you can write an interface into the application to do so.

You can also add other capabilities via third-party libraries. Instead of writing a serial-port interface as in the previous example, you might be able to buy a library that provides serial-device support routines. Then you'd simply have to link it into your application. Other capabilities, such as statistical services or windowing facilities, can be added to the application in this manner.

An HLL database application doesn't

have the file-handling and network restrictions common to those created with *dBASE*. It can know the underlying database file format and access method as well as other file formats, and can update data in any file whose format it understands. Furthermore, most database libraries don't

After performance,
flexibility is perhaps
the next-best reason to
write a database
application using the
combined talents
and power of a
high-level language
and a database
library or engine.

limit the number of network workstations your application can support.

HLL applications, particularly those written in C, are also more flexible because they will be more portable than *dBASE* applications. C is available on every machine from a Commodore 64 to a Cray-2. And a vendor is more likely to port a database library from one platform to another than an entire DBMS like *dBASE*.

HLL DEBUGGING

HLL applications, particularly those written in C and Pascal, are more difficult to debug than *dBASE* applications. Not only is it easier to introduce bugs in these applications, but then you have to distinguish between application bugs and library bugs. And because you use more than one body of software developing HLL applications, you are more vulnerable to bugs introduced by compiler code generation and optimization.

HLLS CALL FOR EXPERIENCE

To build well-structured HLL-based applications using a language that neither demands nor enforces structure definitely requires experience. It also takes skill to

build a strong library interface where the application doesn't have to know a great deal of underlying detail about the library and engine, and where many tasks are encapsulated into a single library function call.

A seasoned developer knows the consequences of recklessly using a pointer: it can destroy program data and data files, and cause the application and the system to crash. Experience also teaches you that certain bugs may "disappear" when you change the program (as by adding a debugging statement) only to "reappear" later; and database libraries implemented as TSRs are prone to crashing the system and conflicting with other TSRs or device drivers—particularly network drivers. They can also take up more memory, since the entire engine remains resident, whereas an overlaid system does not.

OVERHEAD

Unless you're using an engine or library that's linked to an interactive front end, you'll have to write programs just to set up data entry screens. This could prevent data entry from beginning early in the development cycle, or could unnecessarily delay the early stages of program development.

Also, there's a high likelihood that it will take more work to write the code for implementing multiuser file handling on a network, whereas this may be transparent with *dBASE*.

You usually need additional software to create an HLL application: compiler, linker, and so on. And you may need to purchase updated versions of the database library or engine as updates of the compiler software are released.

NEXT TIME

One of the most recent database engine releases is *Paradox Engine* from Borland. In the next issue, we'll dig in and take a close look at *Paradox Engine* and why it makes a strong case for developing applications using HLLs.

LET US HEAR FROM YOU

Share your database experience, tips, and techniques, and we'll pay you \$50 for any tips we print. Please send them on-disk and include a printout. Mail your contributions to DATABASES, *PC Magazine*, One Park Avenue, New York, NY 10016.

Research for this article was provided by Richard Hale Shaw, a contributing editor of PC Magazine.

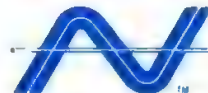


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And Samuel F.B. Morse, father of an earlier form of communications, before the world became computerized. (If you think we're making this up, check out Morse's be-medaled photo on the back page of this special Northgate insert.) In the meantime, we could go on and on with the reasons to buy a Northgate system, but we thought the awards said it better than we could.

1. PC Magazine "Editors' Choice" award: 80286 SuperMicro. (PC Magazine, January, 1989)
2. PC Magazine "Editors' Choice" award: 80386 Elegance 20 MHz. (PC Magazine, May, 1989)
3. PC Magazine "Editors' Choice" award: 80386 Elegance 25 MHz. (PC Magazine, May, 1989)
4. PC Magazine "Editors' Choice" award: 80386 Elegance 33 MHz. (PC Magazine, October, 1989)
5. Computer Shopper "Best Buy" awards, three years in a row, based on a vote of the magazine's readers. • Best Buy — complete computer system • Best Buy — overall (all products advertised in the magazine) • Best Buy — Input device: Northgate Omnikey Keyboard.
6. Infoworld. In April of 1989, they saluted Northgate's Elegance 386/25 with the headline: "The Elegance 3000 among the fastest 25-MHz systems." (Infoworld, April 10, 1989). In November, in their review of our Elegance 386/33, they said the following: "Northgate's Elegance 386-33/2000 computer is a top product in most of our scoring categories including value, where it earns just the second excellent mark we've awarded to 33 MHz systems." Overall rating 9.1, their highest ever.
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PHOTO: HARRY LANGDON

THE NORTHGATE 386 33 MHZ ELEGANCE SYSTEM

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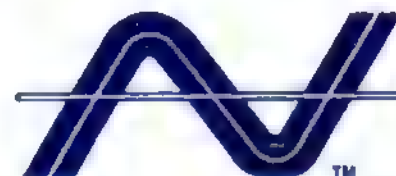
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THE NORTHGATE OMNIKEY/PLUS

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On May 24, 1844 Samuel F. B. Morse, father of the Telegraph, typed out the first message ever sent over a wire: "What Hath God Wrought?"

He didn't exactly type it. He tapped it.

Samuel F. B. was a great inventor, but he was working at a disadvantage; he only had one key. Think what might have happened if he'd had the full Omnikey Plus keyboard, pictured above?

He might have invented the Computer.

In the meantime, you may not realize that Northgate *did* invent a key of its own: the F-13 key, which we'll explain shortly.

This was recently pointed out by the Computer Editor of The New York Times, Peter H. Lewis, in the Jan. 2, 1990 edition. There, in The Science section, was a very nice review of Northgate's Omnikey, which carried the headline: A KEYBOARD WITH A DIFFERENCE.

Mr. Lewis told how he recently got his hands on Northgate's keyboard and, as a result, replaced his old "mushy keyboard...with the crisp Omnikey Plus."

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Two days into the nineties, and already Northgate's upstart Omnikey Plus, was getting raves from the N.Y. Times. In the laid-back, conservative style of The N.Y. Times, "we like it a great deal," may be considered a rave.

As long ago as August, 1988 a reviewer named Burton L. Alpers (Andrew Seybold's Outlook On Professional Computing) put it this way: "Northgate got it right. They have combined the best features of the I.B.M. keyboard layout with outstanding keyboard feedback. It's like coming home again, but better. In the first place, all the keys are where they should be...most important, all the function keys are back where they belong, on the left



TELEGRAPH KEY (CIRCA 1920)

side, in the same arrangement as the original PC keyboard.

As a point of reference, on a subjective 1-10 scale of mush to well defined feedback, I would rate the Compaq keyboard as a 1, an I.B.M. keyboard as an 8, and a Northgate Omnikey/102, as a 10."

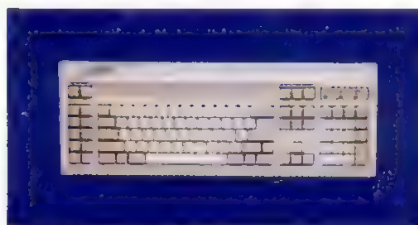
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OMNIKEY 102 (CIRCA 1990)

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- PC Magazine "Editor's Choice": December, 1989.
- Computer Shopper Magazine "Best Buy," November, 1989.

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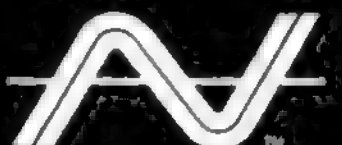
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by
Michael J. Mefford

Utilities

Whenever you sit on the Backspace key to erase a line or enter a long series of dashes, asterisks, or underscores with a single key-press, you immediately appreciate the importance of your keyboard's *typematic* action. You've probably also discovered, however, that its repetition rate is maddeningly slow and that its initial delay seems to take an eternity.

If you find yourself pressing harder and harder on the particular key you want to repeat—knowing full well that these efforts won't speed up its action—I've got a solution for your frustration. In this article I'll give you a choice between two programs, either of which will put some zip into your keyboard. On the other hand, your touch might be too heavy, so that an increase in keyboard sensitivity is exactly the opposite of what you need. But with one of these programs you can actually slow down the typematic action.

The typematic characteristics of the XT and the early ATs are a fixed, integral part of the keyboard hardware. The delay before the first repeat is about 1/2 second, and the repeat rate thereafter is approximately 10 or 11 characters per second (cps). The first program presented here, TYPEFAST, is a TSR (terminate and stay resident) utility that circumvents the keyboard hardware limitations by hooking the keyboard and timer interrupts and stuffing the keyboard buffer with repeat keystrokes at the rate you select.

For late ATs and all PS/2s, IBM added BIOS and hardware support that enables you to change the typematic rate and initial delay of the keyboard. Unfortunately, even if you have one of these ATs (or an 80386-based AT compatible), you may not know how to modify its typematic rate. This is understandable: most such machines do not provide any easy way to change it. TPFST-AT, the second program presented here, fills that gap and gives you handy access to this otherwise inaccessible keyboard hardware.

TYPEFAST will work with all machines, including the XT, AT, and PS/2.

TYPEFAST and TPFST-AT Give Your Keyboard Pizzazz

■ With either of these two utilities, you can reset your keyboard typematic rate and initial delay at the speed that best suits your needs and tastes.

TPFST-AT, on the other hand, will work only with some ATs, the XT 286, and PS/2s. If you're not sure which class machine you have or whether or not you can take advantage of TPFST-AT, the sidebar "Will TPFST-AT Work for You?" will help you decide.

TYPEFAST.COM and TPFST-AT.COM are available on PC MagNet. Note that the sidebar "TYPEFAST by Modem" gives you instructions for downloading both utilities from PC MagNet. You can also download both programs' assembly language source code and BASIC listings, which will produce the two .COM files when run. Alternatively, you can get the assembly or BASIC listings by mail or fax by sending a post card with your name, address, and fax number (if applicable) to Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016; Attention: Carolyn Falconer. No phone calls please. (Please note: estimated fax length is 7 pages.)

In order to create both TYPEFAST.COM and TPFST-AT.COM from the source code, you must use a macro assembler (IBM or Microsoft, Version 2 or later),

as well as the following set of commands:

```
MASM TYPEFAST;  
LINK TYPEFAST;  
EXE2BIN TYPEFAST TYPEFAST.COM
```

or

```
MASM TPFST-AT;  
LINK TPFST-AT;  
EXE2BIN TPFST-AT TPFST-AT.COM
```

Since TYPEFAST is the more universal of the two programs, I'll begin with it. The syntax for TYPEFAST is

```
TYPEFAST [m][,n] | [/U] | [N]
```

where *m* is a decimal number from 0 through 31. The optional *m* parameter sets the typematic rate: the larger the number, the more quickly keystrokes will be repeated after the initial delay. The second optional parameter, *n*, sets the initial delay, that is, the interval between the time you depress a key and the beginning of typematic repetition. The values for *n* range from 0 to 3, and the larger the number, the longer the delay.

If you don't enter any parameters, TYPEFAST defaults to a repeat rate of 2 and a delay of 3. A TYPEFAST repeat rate of 2 translates into about 17 characters per second. The default maximum delay of 3 corresponds to the same 1/2 second that you normally get with the keyboard hardware. The parameters cannot easily be translated into fractions of a second, however, and so should be thought of simply in terms of a

Utilities

The resident portion of TYPEFAST can be broken down into its two component interrupt handlers. The keyboard handler is responsible for monitoring keypresses and releases, and the timer handler does the actual stuffing of repeat characters into the keyboard buffer.

The first thing the keyboard handler does when it gets control is to tell the timer handler to temporarily suspend stuffing the keyboard buffer until it can determine what action should be taken. This step is necessary because an interrupt 8 has priority over an interrupt 9. Without that temporary suspension, TYPEFAST's keyboard handler could be interrupted by a timer tick, which would give control to TYPEFAST's buffer stuffer.

Next, the keyboard handler uses a far call to pass control, via interrupt 9, to the BIOS to interpret the keystroke. The call is prefaced by pushing the flags on the stack, essentially emulating an interrupt. This ensures that control will be passed back to TYPEFAST when the BIOS has finished interpreting the scan code.

On return, TYPEFAST checks to see whether the keyboard-buffer tail pointer was moved by the BIOS. This would indicate either that a (non-Shift) key was pressed or that a keyboard typematic repeat occurred. If the tail has indeed been moved, TYPEFAST checks to see whether the new scan code just stored by the BIOS interrupt 9 matches the scan code from the last interrupt. At the same time, the new scan code is saved as the latest one received, for the comparison the next time through.

If the scan codes match, TYPEFAST can assume the interrupt was triggered by a normal keyboard typematic response. Remember, even while TYPEFAST is stuffing copies of characters into the buffer to increase the typematic rate, the keyboard *also* continues to send its regular typematic copies. If a keyboard typematic is detected, no action is taken. Otherwise, TYPEFAST knows that a new key was pressed and reacts by resetting the timer handler's initial delay. In either case, on exit, TYPEFAST reenables the timer handler's stuffing procedure.

The keyboard handler takes a different course if the buffer's tail does not move. TYPEFAST then knows that the interrupt was activated by a key release, a Shift key,

or one of the special scan codes of the 101 keyboard. The key release (or break) code for any key is the key-make scan code plus 80h. A Shift key scan code looks the same as a keypress—that is, no 80h is added. If either a key release or Shift key is detected, and the timer handler has been stuffing repeat characters, TYPEFAST empties the keyboard buffer by setting the buffer head equal to the buffer tail. This action prevents the possible cursor overshoot I discussed earlier.

Testing for the 80h bit 7 as a key-release cue has a potential pitfall into which many an unwary program has fallen. Prior to the introduction of the 101 keyboard, bit 7 was an accurate method of detecting key breaks. The 101 keyboard, however, sends a prefacing E0h scan code before

**KBBUFFER.CTL can
expand the keyboard
buffer if TYPEFAST
fills it too quickly.**

sending the scan codes for the new dedicated cursor-control keys. E1h is sent as part of the dedicated Pause-key scan-code sequence, and of course, both E0h and E1h have bit 7 set. The consequence is that any pre-101 keyboard program that interprets bit 7 as synonymous with a key break will not work properly.

TYPEFAST avoids this trap by stripping the bit and checking whether the resulting scan code matches the last key-make scan code. A mismatch will always occur with the special codes because there are no key-make scan codes of 60h and 61h, which are the results from a stripped E0h and E1h, respectively.

The timer interrupt handler decrements a counter each time it is called. The counter is equal to the delay parameter given on the command line. When the counter times out, TYPEFAST goes about its business of stuffing copies of the last character into the keyboard buffer. The repeat rate is controlled by one of eight byte patterns, chosen from the typematic value given on the command line. The first pattern has 1 bit set, and each succeeding pattern has an additional bit set. The last byte pattern has all 8 bits set.

Each time the stuffing process is called, it rotates the pattern through the carry flag and adds a repeat character to the keyboard buffer only if the carry flag was set. For the first pattern, with 1 bit set, this will happen every seventh time the timer handler is called and the delay has already expired. For the last pattern, with all bits set, a copy will be stuffed in every time. The increasing bit patterns thus control increasing typematic rates. Of course, if the buffer is already full (that is, if the tail has caught up with the head), TYPEFAST just exits the timer procedure.

With the system timer interrupt occurring 18 times a second, this algorithm would result in TYPEFAST adding a maximum of only 18 characters per second to the keyboard's inherent 11 characters per second. I wanted to offer even faster typematic rates, however, so I arranged for TYPEFAST to use the same pattern in three sets. For rates of 0 to 7 cps, the pattern technique described above is used alone. For rates from 8 to 15 cps, a character is stuffed each time the timer handler is called and the delay has timed-out, and an additional character is added if the pattern method is met. Finally, rates of 16 to 31 cps are achieved by stuffing two characters before checking the pattern. With a typematic rate of 31, therefore, three characters are dumped all at once into the keyboard buffer at the end of each 55-millisecond period. Since the keyboard slips in its own repeat character every 90 ms, however, you can see the reason for the potential graininess of TYPEFAST's typematic rate.

EXPANDING THE KEYBOARD BUFFER

If your new speedier keyboard ends up filling the keyboard buffer too quickly—the beep will be your clue—you should also download a copy of KBBUFFER.CTL from PC MagNet. KBBUFFER.CTL is a device driver that expands the keyboard buffer. You simply add it to your CONFIG.SYS file, as follows:

```
DEVICE={path}KBBUFFER.CTL
```

The optional *bufsize* parameter is a decimal number between 16 and 200 that sets the desired keystroke capacity of the new keyboard buffer. The default size of the KBBUFFER.CTL buffer is 80 keystrokes, which should suffice in most situations. ■

Michael J. Mefford is a contributing editor of PC Magazine.

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has to do is interpret the command-line parameters. Once the rate has been determined, TPFST-AT passes that information on to a BIOS interrupt 16 function call. The BIOS, in turn, sends signals to the keyboard that change the rates. TPFST-AT's parameters are directly related to the valid values accepted by the BIOS typematic call.

WHICH PROGRAM FOR YOU?

There are several subtle differences between the two programs, and each program has its own distinct advantages. In general, TPFST-AT is to be preferred over TYPEFAST because it changes the typematic rate through a BIOS-supported call. TYPEFAST, on the other hand, is a TSR and so—though it is about as well behaved as TSRs can be—it may conceivably not work properly with some other memory-resident applications.

TYPEFAST uses the system timer tick to pace its insertion of typematic characters in the keyboard buffer. The resolution of the timer tick is only about 55 milliseconds, which is actually a little crude in this

application. TYPEFAST's operation, therefore, is not quite as smooth as TPFST-AT's hardware control. Moreover, unlike TYPEFAST, TPFST-AT lets you slow things down, if you like. If you want to see a really sluggish keyboard, just use a repeat rate of the minimum 0 and a delay of the maximum 3. The repeat rate will drop to 2 cps and the delay will increase to a full second. This is possible because the newer keyboard hardware is programmable.

The main advantage that TYPEFAST has over TPFST-AT is its ability to stop its typematic action on a dime. This may require a little explanation. TPFST-AT merely changes the rate at which the keyboard sends repeat characters. If the application can't keep up with the increased pace, the excess keystrokes will be stored, as usual, in the keyboard buffer. Now let's suppose that you're using a word processor and that you are holding the Down Arrow key to move to a new place farther down in the text. If moving the cursor down involves scrolling the text up, the application's display update may take longer than the arrival of the next typematic Down Arrow command. The additional Down Arrow keystrokes will begin to accumulate in the keyboard buffer. When the desired text

appears on the screen and you release the Down Arrow, the word processor will continue to move the cursor down as it processes the remaining Down Arrows still stored in the buffer. The result is you will end up overshooting your destination.

This problem does not occur with TYPEFAST. When TYPEFAST detects a key release, it immediately clears any remaining unused key repeats from the buffer, so the cursor will stop right where you want it. With one exception! There are some applications that retrieve keystrokes from the keyboard buffer as fast as they are typed in. These applications store the keystrokes in their own, larger buffer, precisely to avoid the beep of an overfilled keyboard buffer. TYPEFAST's technique of clearing the keyboard buffer to avoid possible overshoot will obviously not help in such programs.

The default accelerated rate for both programs is about 17 cps, with a normal 1/2 second initial delay. The maximum rate for TPFST-AT is 30 cps, nearly three times the normal rate. TYPEFAST's maximum is too fast for me even to estimate. If, however, neither of the programs' maximum rates is fast enough for you, try them together. I guarantee your keyboard will become so much faster than a speeding bullet that even Superman won't be able to keep up with it. In a more realistic vein, I suggest that you start with the defaults by running the program you choose without the optional *m* and *n* parameters and then experiment to find the pace that suits your touch.

THE PROGRAMMING ANGLE

For programming enthusiasts, what follows is a blow-by-blow account of the inside workings of TYPEFAST. When you first run TYPEFAST, it installs itself by hooking the two most commonly hooked vectors, the keyboard interrupt 9 and the timer interrupt 8. As with all TSRs, the installation code is discarded, and only the interrupt handlers remain resident. TYPEFAST prevents multiple installations by the proven method of searching through memory for an existing copy of the copyright notice that heads the program. The first byte of TYPEFAST is first changed so that the memory search won't turn up a copy of itself that may reside in a DOS disk buffer or a resident disk cache. The changed byte acts as a double confirmation that the resident TYPEFAST is found; a buffered or cached copy will be an unaltered disk image.

UTILITIES UPDATES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The only way to obtain the modified versions is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
BEN51.EXE (Benchmark Tests, Version 5.1)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2 (now works with volumes greater than 32MB)
DIRMATCH.COM, Version 1.1
EMS40.SYS, Version 1.1 (fixes a problem with *Lotus 1-2-3*)
LITES.COM, Version 1.1
LOG.COM, Version 1.1
PCMANAGE.EXE, Version 1.1
RN.COM, Version 2.0 (now works under DOS 4.x).
SLICE.COM, Version 1.3

SNIPPER.COM, Version 1.2

ZCOPY.COM, Version 1.2

For a complete list of all the programs available from the PC MagNet Utilities Database, download UDCAT.ARC.

A downloadable index to *PC Magazine's* product reviews is also available. PCM.EXE is a self-extracting file that contains the *Computer Library PC Magazine Reviews Index* for January 1988 to June 1989. This easy-to-use database is a subset of the *Computer Library Periodicals Database*, which is available on CD-ROM and on PC MagNet. It requires the search files in PCSRCH.EXE.

PCSRCH.EXE is a self-extracting archive containing the software used to retrieve citations from the *PC Magazine Reviews Index*. Please be sure to read the information file PCM.INF before you attempt to download any of these files from PC MagNet. ■

TYPEFAST BY MODEM

The programs published in *PC Magazine* are available by modem from PC MagNet.

To join PC MagNet, set your communications software for either 300 or 1,200 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex. To find the number nearest your dialing exchange, dial (800) 346-3247. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you.

After you have found the phone number nearest you, hang up and redial using that number. When you connect with PC MagNet, press Ctrl-C. At the HOST NAME prompt, enter CIS. At the USER ID prompt, enter 177000.5000. Enter PC*MAGNET at the PASSWORD prompt and Z10D9008 at the ENTER AGREEMENT NUMBER prompt. For Customer Service, call (800) 848-8990; outside the United States, call (614) 457-8650.

To download TYPEFAST.COM, TPFST-AT.COM, and their assembler or BASIC listings, log on to PC MagNet. Enter GO UTILITIES or choose PC MAGAZINE UTILITIES from the top menu, then DIRECT UTILITY DOWNLOAD from the next menu. Enter the filename, then select the file you want to download from those presented. Answer yes (Y) to DO YOU WISH TO DOWNLOAD? Press Enter to see the transfer protocols. Choose a protocol and download the file.

You don't have to be a member of CompuServe to access PC MagNet. It costs \$12.80 an hour for 1,200/2,400-bps service and \$6.30 for 300-bps, via MasterCard, VISA, or American Express. These programs can be copied but are copyrighted and are made available only for noncommercial use. You may make copies for others as long as no charge is involved, but making copies for any commercial purpose is prohibited.

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TYPEFAST and TPFST-AT Commands

Michael J. Mefford

April 24, 1990 (Utilities)

Purpose:

To change the default keyboard typematic rate and initial delay. TYPEFAST.COM is a memory-resident (TSR) utility that works with all XT and later PCs and clones; TPFST-AT.COM is nonresident, and works only with late-model ATs (BIOS date 11/15/85 or later) and with XT 286, PS/2, and some 386-based PCs that are fully AT-compatible.

Format:

TYPEFAST [*m*] [, *n*] | [/U] | [N]
or
TPFST-AT [*m*] [, *n*] | [N]

Remarks:

Entered without any optional parameters, both TYPEFAST and TPFST-AT default to a repetition rate of approximately 17 characters per second (11 cps is the normal keyboard typematic rate) with a standard initial delay of 1/2 second. The optional *m* parameter sets the repeat rate and *n* sets the delay.

For TYPEFAST, the *m* value may range from 0 to 31 (the default is 2), and *n* value may range from 0 to 3 (default 3). For TPFST-AT, *m* values also range from 0 to 31, but in this case the default value of 27 corresponds to the 17-cps repeat rate. TPFST-AT *n* values range from 0 to 3 (default 1). The same numeric value for the optional *m* and *n* parameters does not produce the same result in the two programs, though in both cases the larger the number, the greater the repetition rate and initial delay. When executed, both programs show the appropriate syntax parameters on the screen. A single parameter may be entered (preceded by a delimiting comma if the first parameter is omitted) if the default value is satisfactory for the missing value.

When installed, usually by being made part of an AUTOEXEC.BAT file, TYPEFAST occupies approximately 300 bytes of RAM. The program can subsequently be run again with new parameters without further memory penalty. Subject to the usual TSR limitations, TYPEFAST can be uninstalled by running it with the /U switch. The N option restores the normal typematic rates.

Since TPFST-AT is not memory resident, it cannot be uninstalled. To revert to the normal typematic speeds, simply use the N switch. TPFST-AT provides slightly smoother response and permits the keyboard to use slower or faster than normal rates. TYPEFAST, on the other hand, provides better insurance against overshooting the desired stopping point.

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Utilities

gradient scale. Just remember that the larger the number, the greater the repeat rate or the initial delay. To make things easier still, whenever you enter TYPEFAST, the complete syntax and defaults are displayed.

You may enter one parameter without the other; the default value is used for the one omitted. For example, if you wish to

keep the default repeat rate of 2 but want a quicker initial response, you might enter the command

```
TYPEFAST ,1
```

Note that the delimiting comma indicates that the first parameter is missing and the default repeat rate will be used.

As indicated earlier, TYPEFAST is a TSR. While it can be entered at the DOS prompt, its natural home is in your AUTOEXEC.BAT file. The first time you en-

ter TYPEFAST, the utility will install itself, taking up a little over 300 bytes of memory—a small price to pay for gaining a livelier keyboard. After installation you can change the parameters simply by entering TYPEFAST again, but this time with different *m* and *n* values. And no matter how many times you change the values, the program is smart enough to load itself only once, so you won't lose any more memory. You can use the N option to return the typematic rate to normal.

You can also use the /U switch if you wish to uninstall TYPEFAST from memory and return the typematic rate to its natural state. As always, TSRs must be uninstalled in the reverse order that they were installed. Otherwise, unrecoverable holes will be left in memory. If this happens with TYPEFAST, you will be informed that TYPEFAST is inactive but could not be uninstalled. In this case, you can later reactivate the same resident code by entering TYPEFAST once again. If you use *SideKick*, remember that it insists on being loaded last.

The alternative that is presented here to TYPEFAST is TPFST-AT, whose syntax looks very similar:

```
TPFST-AT [,m][,n] | [N]
```

Again, the *m* and *n* parameters represent the typematic rate and initial delay, respectively. The range for the repeat rate is also the same, 0 through 31, but here the syntax similarities end. TPFST-AT's default rate is 27, which produces the same 17 cps as TYPEFAST's 2. The delay range, *n*, is 0 through 3, and its default value of 1 results in an unaltered 1/2 second delay. Note that the same numeric parameters used for both programs will not produce the same results. They are not interchangeable, though it remains true that the larger the number, the greater the rate and delay.

You'll also notice that there is no /U switch. That's because TPFST-AT is not a TSR. This also means you can't uninstall TPFST-AT to return the default keyboard rates, as you can with TYPEFAST. To restore the keyboard to normal, simply use the N option. Again, however, so that you won't have to remember them, the normal parameters appear along with the defaults and the syntax whenever you enter TPFST-AT.

Since TPFST-AT is not a TSR, there is no displacement of memory. The lack of the TSR overhead also makes TPFST-AT a much shorter program; basically, all it

WILL TPFST-AT WORK FOR YOU?

by Michael J. Mefford

There are several ways to determine whether TPFST-AT.COM will work on your machine. According to the IBM BIOS *Technical Reference*, the programmable typematic rate and delay functions apply to AT machines with a BIOS dated 11/15/85 and after, to the PC XT Model 286, and to Personal Systems/2 products.

Machines that fall into any of these categories will support TPFST-AT. If you have an AT and you don't know what its BIOS date is, you can find out by loading DEBUG and entering

```
D F000:FFF5 L8
```

This will display (on the far right of the screen) the BIOS date for any IBM machine.

Of course, the *IBM Technical Reference* applies to IBM products. For clone owners the date stamp criterion is not reliable. The real test is to see whether your machine actually responds to the typematic BIOS call. You can do this while you're still in DEBUG by creating a short test program that attempts to change the rate. At the DEBUG hyphen prompt, enter the following commands:

```
A          ;Assemble.
MOV BX,100  ;Typematic rate of
           30
MOV AX,305  ;Set typematic rate
INT 16      ; via BIOS.
MOV BX,10B  ;Normal rate of
           10.9
MOV AX,305  ;Set typematic rate
INT 16      ; via BIOS
```

In the lines above, everything after (and including) the semicolon is a comment and does not need to be entered. Note, however, that you must press Enter twice after the second INT 16 instruction to discontinue the assembly process and return you to the DEBUG hyphen prompt. Now you can accelerate the typematic to the highest supported rate of 30 characters per second by entering

```
G 100
```

This will execute the first three instructions. To test if the typematic rate has been changed, press and hold down the A key. If a stream of As quickly fills the line, the rate has been changed; the increase in typematic rate will be quite noticeable. Passing this simple test means that TPFST-AT will work on your machine. If it doesn't, you'll simply have to use TYPEFAST to change the typematic rate.

Still in DEBUG, to return the typematic rate back to normal, first remove the As by pressing Esc and Enter. A new hyphen prompt will appear. Then enter

```
G 110
```

This will execute the last three instructions, which restore the typematic rate to the normal 10.9 characters per second. Then simply enter

```
Q
```

to quit DEBUG and return to the DOS prompt. ■

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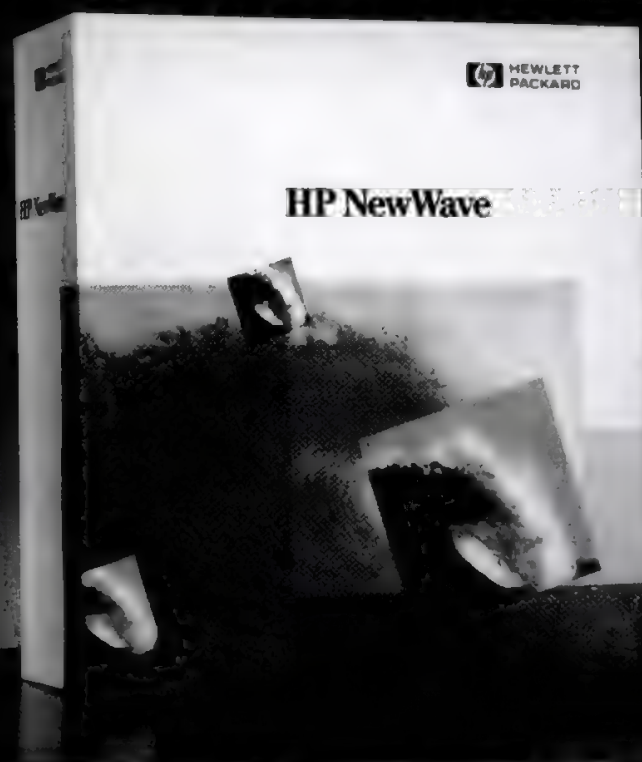
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by
Charles Petzold

Environments

You'd think that a device-independent graphics interface—such as the one included in the OS/2 Presentation Manager—would make printer graphics as easy as video graphics. Guess again, my friend!

A printer is intrinsically different from a video display and definitely more difficult for both programmers and users. Have you ever had a video display run out of paper or get jammed?

Moreover, while the OS/2 Presentation Manager can use only one video display, multiple printers can be installed on the same machine. The OS/2 installation program can determine which video display driver to use, but the installation of printer drivers has to be left up to the user. A Presentation Manager program must obtain information from OS2.INI to determine information about installed printers.

Another essential difference is that a window on a video display is a reusable device that can be erased and redrawn. A printer turns out a "document" that may comprise multiple pages. Thus the PM program must make use of function calls to start a document, end a document, and separate the pages.

Displaying graphics on a printer page generally takes longer than displaying graphics on a video display. As I discussed in the last issue, this suggests that a PM program should create a second thread of execution when using the printer.

THE PRINTCAL.C LISTING

In this column, I'll continue my discussion of PRINTCAL, a Presentation Manager program that prints a wall calendar, one month to a page, while displaying a month in its client window. Four of the six files needed to create PRINTCAL.EXE were presented in the last issue, and a fifth (PRINTDC.C) was discussed in the February 27, 1990, issue. The sixth file, PRINTCAL.C, is shown in Figure 1.

This program demonstrates the basics of how to print from a PM program. So you won't lose sight of the forest while ex-

Printing Under the OS/2 Presentation Manager, Part 4

■ PRINTCAL.C shows that printing from the PM is a lot more complicated than using a call to DOS interrupt 17h, but the results are worth it.

amining the trees, here are the steps involved in printing a document:

- Open a device context for the printer. This requires that the program use WinQueryProfileString to obtain information about the printer, transfer this information to one (or possibly two) data structures, and call DevOpenDC. (This part of the job was covered in the Environments column in the February 27, 1990 issue.)
- Create a presentation space (PS) associated with that device context by calling GpiCreatePS.
- Begin a document by calling DevEscape with the DEVESC_STARTDOC parameter.
- Draw a page of text and graphics by calling GPI functions.
- End the page by calling DevEscape with the DEVESC_NEWFRAME parameter.
- Repeat the last two steps for each page in the document.
- End the document by calling DevEscape with the DEVESC_ENDDOC parameter.
- Clean up by destroying the printer pre-

sentation space (GpiDestroyPS) and closing the device context (DevCloseDC).

These steps should be performed in a second thread of execution, so the user doesn't have to wait for the program to finish them. Also, the main thread and printing thread have to communicate in some way. Figure 2 is a diagram of this process.

DRAWING THE CALENDAR PAGE

The DisplayPage function, beginning about two-thirds of the way into the PRINTCAL.C listing, is used to display one month of the calendar on either the program's window or a printer page. None of the overhead involved in printing is in this function: it is pure, device-independent graphics programming.

There are four DisplayPage parameters: a handle to a presentation space (this is required for all the GPI drawing functions; it references either a window or printer PS); a SIZEL structure with the horizontal and vertical dimensions of the drawing surface (either the window or the printer page); a year (from 1900 to 2099); and a month (0 through 11).

DisplayPage begins by calculating the two fields of the sizlCell variable. This is another SIZEL structure, which describes the horizontal and vertical dimensions of the box containing each day. Both of these dimensions are 1/7th of the horizontal and vertical dimensions of the page.

The GpiCreateLogFont function obtains a GPI vector font, the font identified by the Helv facename. If the Helvetica font is not available, GPI will use a default

Environments

Courier vector font instead. The GpiSetCharSet function sets this font in the presentation space for subsequent text.

A GPI vector font must be scaled to the desired size, using the GpiSetCharBox function. The second parameter to this function is a SIZEF structure with two fields; these designate the horizontal and vertical sizes of the characters. The vertical size is the distance from the top of the uppercase letters to the bottom of lowercase descenders, not including leading used for diacritical marks and line spacing. For a normal-looking font, the vertical size should be set to equal the horizontal size.

I use GpiQueryTextBox (which determines the dimensions of a box that contains a text string), together with the default character box to find the size of the character box. The aim is to make the month and year heading as large as possible while maintaining equal horizontal and vertical character-box dimensions. Gpi-

CharStringAt displays the heading at the top of the page (or screen).

The DisplayPage function then sets the dimensions of the character box to the lesser of 1/4 the width or the height of the day cell. This character-box size is used for the numbers of each day. After the function calculates a few variables to determine the day of the week on which the month begins, a for loop cycles through all the days. The GpiMove and GpiBox functions draw a box, and GpiCharStringAt displays the day of the month.

Now let's examine PRINTCAL from the top down to see how the program uses this routine to draw the calendar page on both its window and a printer page.

WINDOW PAINTING

The main function in PRINTCAL is fairly normal. The only oddity is that the message loop (the WinGetMsg and WinDispatchMsg functions) is enclosed within a while block. I'll discuss the significance of this toward the end of this article.

As usual, ClientWndProc is the window procedure of PRINTCAL's client

window. During the WM_CREATE message, ClientWndProc calls GpiCreatePS to create a presentation space associated with the window.

Even if you've done some Presentation Manager programming, the use of GpiCreatePS may be new to you. Small PM programs generally use WinGetPS or WinBeginPaint (with a NULL second parameter) to obtain a *cached micro presentation space* for a window. This is a PS that the system creates for use by programs. It is always associated with a window on a video display. A cached micro PS must be obtained and released in the course of a single message.

I use GpiCreatePS in this program because the same function is required to create a PS for the printer. It might be helpful to compare and contrast the use of the two functions. To create a PS for a window, you must first call WinOpenWindowDC to obtain a device context handle for the window. The PS is associated with that device context.

The last parameter of GpiCreatePS includes the PU_ARBITRARY identifier.

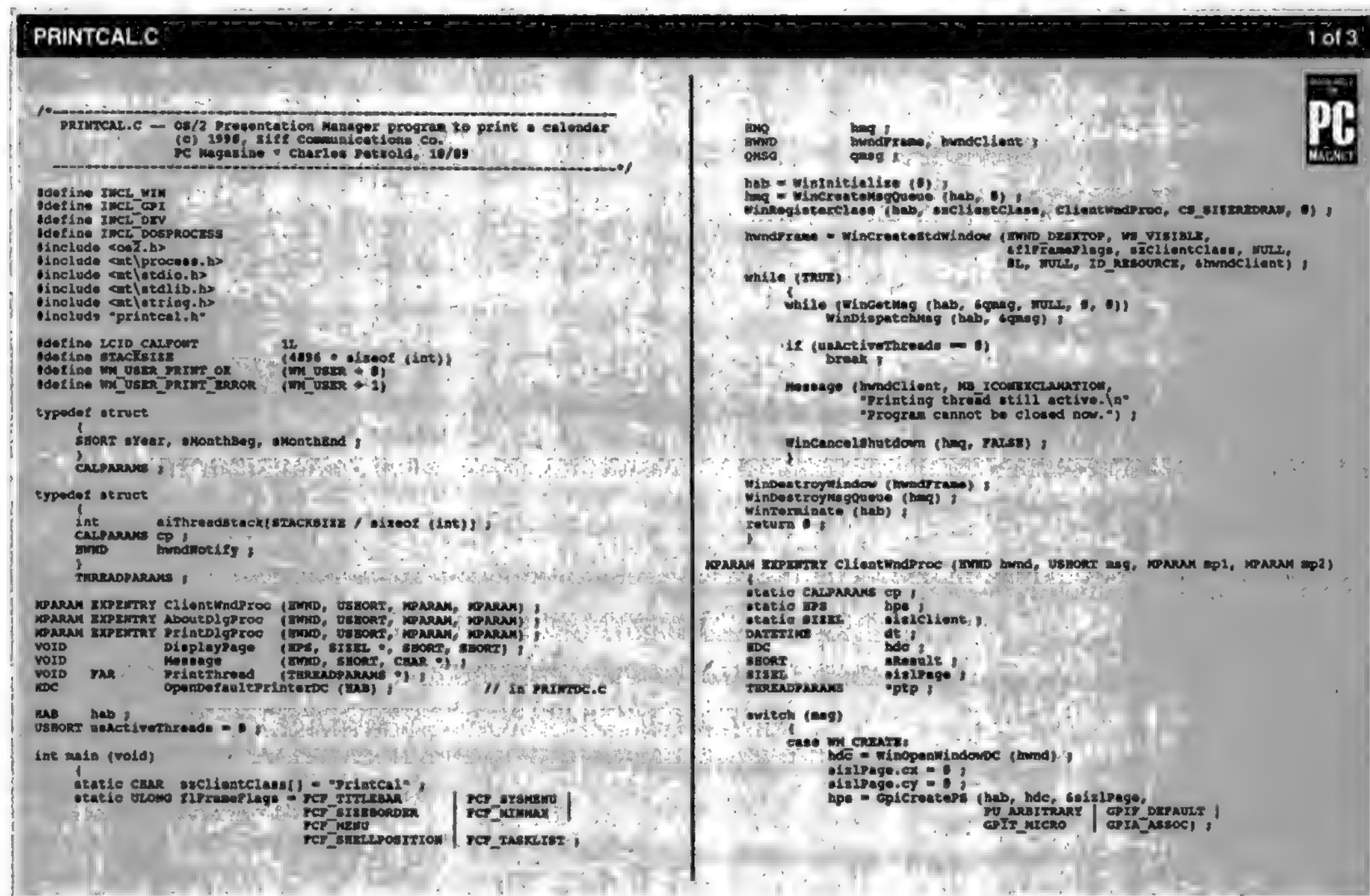


Figure 1: The source code for the PRINTCAL program, which prints a wall calendar, one month per page. This is only one of the six files needed to create PRINTCAL.EXE. You can find the other five files in the previous two Environments columns.

```

DoeGetDateTime (ldt) ;
cp.sYear = dt.year ;
cp.sMonthBeg = dt.month - 1 ;
cp.sMonthEnd = dt.month - 1 ;
return 0 ;

case WM_SIZE:
    siClient.cx = SHORTFROMHP (mp2) ;
    siClient.cy = SHORTFROMHP (mp2) ;

    GpiConvert (hps, CVTC_DEVICE, CVTC_PAGE, 1L,
        (PPOINTL) &siClient) ;
    return 0 ;

case WM_PAINT:
    WinBeginPaint (hwnd, hps, NULL) ;

    GpiErase (hps) ;
    DisplayPage (hps, &siClient, cp.sYear, cp.sMonthBeg) ;

    WinEndPaint (hps) ;
    return 0 ;

case WM_COMMAND:
    switch (COMMANDMSG(&msg)->cmd)
    {
        case IDM_ABOUT:
            WinDlgBox (HWND_DESKTOP, hwnd, AboutDlgProc,
                NULL, IDD_ABOUT, NULL) ;
            return 0 ;

        case IDM_PRINT:
            sResult = WinDlgBox (HWND_DESKTOP, hwnd, PrintDlgProc,
                NULL, IDD_PRINT, &cp) ;

            if (sResult == DID_CANCEL)
                return 0 ;

            WinInvalidateRect (hwnd, NULL, FALSE) ;

            if (sResult == IDD_PREVIEW)
                return 0 ;

            if ((ptp = malloc (sizeof (THREADPARAMS))) == NULL)
            {
                Message (hwnd, MB_ICONEXCLAMATION,
                    "Cannot allocate memory for print thread!") ;
                return 0 ;
            }

            ptp->cp = cp ;
            ptp->hwndNotify = hwnd ;

            if (_beginthread (PrintThread, ptp->aiThreadStack,
                STACKSIZE, ptp) == -1)
            {
                free (ptp) ;
                Message (hwnd, MB_ICONEXCLAMATION,
                    "Cannot create print thread!") ;
                return 0 ;
            }

            usActiveThreads++ ;
            Message (hwnd, MB_ICONASTERISK,
                "Print job successfully started.") ;
            return 0 ;

        break ;

case WM_USER_PRINT_OK:
    ptp = PVOIDFROMHP (mp1) ;
    free (ptp) ;
    usActiveThreads-- ;
    Message (hwnd, MB_ICONASTERISK,
        "Print job sent to spooler.") ;
    return 0 ;

case WM_USER_PRINT_ERROR:
    ptp = PVOIDFROMHP (mp1) ;
    free (ptp) ;
    usActiveThreads-- ;
    Message (hwnd, MB_ICONEXCLAMATION,
        "Error encountered during printing.") ;
    return 0 ;

case WM_DESTROY:
    GpiDestroyPS (hps) ;
    return 0 ;
    }

return WinDefWindowProc (hwnd, msg, mp1, mp2) ;
}

HRESULT EXPTENTRY AboutDlgProc (HWND hwnd, USHORT msg, NPARAM mp1, NPARAM mp2)
{
    switch (msg)
    {
        case WM_COMMAND:
            switch (COMMANDMSG(&msg)->cmd)
            {
                case DID_OK:
                case DID_CANCEL:
                    WinDismissDlg (hwnd, TRUE) ;
                    return 0 ;

                break ;
            }

        break ;
    }

return WinDefDlgProc (hwnd, msg, mp1, mp2) ;
}

```

```

HRESULT EXPTENTRY PrintDlgProc (HWND hwnd, USHORT msg, NPARAM mp1, NPARAM mp2)
{
    static CALPARAMS cpLocal, *pcpCurrent ;

    switch (msg)
    {
        case WM_INITDLG:
            pcpCurrent = PVOIDFROMHP (mp2) ;
            cpLocal = *pcpCurrent ;

            WinSendDlgItemMsg (hwnd, IDD_MONTHBEG + cpLocal.sMonthBeg,
                AM_SETCHECK, MFFROM2SHORT (TRUE, 0), NULL) ;

            WinSendDlgItemMsg (hwnd, IDD_MONTHEM + cpLocal.sMonthEnd,
                AM_SETCHECK, MFFROM2SHORT (TRUE, 0), NULL) ;

            WinSendDlgItemMsg (hwnd, IDD_YEAR, EM_SETTEXTLIMIT,
                MFFROM2SHORT (4, 0), NULL) ;

            WinSetDlgItemShort (hwnd, IDD_YEAR, cpLocal.sYear, FALSE) ;
            return 0 ;

        case WM_CONTROL:
            if (SHORTFROMHP (mp1) >= IDD_MONTHBEG &&
                SHORTFROMHP (mp1) < IDD_MONTHEM + 12)
            {
                cpLocal.sMonthBeg = SHORTFROMHP (mp1) - IDD_MONTHBEG ;

                else if (SHORTFROMHP (mp1) >= IDD_MONTHEM &&
                    SHORTFROMHP (mp1) < IDD_MONTHEM + 12)
                {
                    cpLocal.sMonthEnd = SHORTFROMHP (mp1) - IDD_MONTHEM ;

                    return 0 ;
                }

            case WM_COMMAND:
                switch (COMMANDMSG(&msg)->cmd)
                {
                    case DID_OK:
                    case IDD_PREVIEW:
                        WinQueryDlgItemShort (hwnd, IDD_YEAR,
                            &cpLocal.sYear, FALSE) ;

                        if (cpLocal.sYear < 1980 || cpLocal.sYear > 2099)
                        {
                            Message (hwnd, MB_ICONEXCLAMATION,
                                "Year must be between 1980 and 2099!") ;
                            WinSetFocus (HWND_DESKTOP,
                                WinWindowFromID (hwnd, IDD_YEAR)) ;
                            return 0 ;
                        }

                        if (cpLocal.sMonthBeg > cpLocal.sMonthEnd)
                        {
                            Message (hwnd, MB_ICONEXCLAMATION,
                                "Begin month cannot be later "
                                "than end month!") ;
                            WinSetFocus (HWND_DESKTOP,
                                WinWindowFromID (hwnd,
                                    IDD_MONTHBEG + cpLocal.sMonthBeg)) ;
                            return 0 ;
                        }

                        *pcpCurrent = cpLocal ; // fall through

                    case DID_CANCEL:
                        WinDismissDlg (hwnd, COMMANDMSG(&msg)->cmd) ;
                        return 0 ;

                    break ;
                }

            return WinDefDlgProc (hwnd, msg, mp1, mp2) ;
        }

VOID DisplayPage (EPS hps, SIZEL *psizlPage, SHORT sYear, SHORT sMonth)
{
    static CHAR *apsMonths[] = { "January", "February", "March",
        "April", "May", "June",
        "July", "August", "September",
        "October", "November", "December" } ;

    static SHORT asMonthLen[] = { 31, 28, 31, 30, 31, 30,
        31, 31, 30, 31, 30, 31 } ;

    static SHORT asMonthStart[] = { 0, 3, 3, 6, 1, 4,
        6, 2, 5, 8, 3, 5 } ;

    CHAR szBuffer[16] ;
    BOOL flLeap ;
    FATRS fat ;
    LONG lLength ;
    POINTL pti, aptl, tBox[TEXTBOX_COUNT] ;
    SHORT sDayStart, sDay, sExtraDay ;
    SIZEP sizp ;
    SIZEL sizlCell ;

    GpiSavePS (hps) ;

    // Determine size of day cell

    sizlCell.cx = (psizlPage->cx - 1) / 7 ;
    sizlCell.cy = (psizlPage->cy - 1) / 7 ;

    // Create the vector font and use it in the PS

    fat.usRecordLength = sizeof fat ;
    fat.flSelection = 0 ;
    fat.lMatch = 0 ;
    fat.idRegistry = 0 ;
    fat.usCodePage = GpiQueryCp (hps) ;
    fat.lMaxBaselineExt = 0 ;

```




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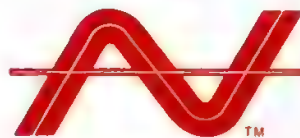
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```

fat.laveCharWidth = 8 ;
fat.laType = 8 ;
fat.laFontUse = FAITH_FONTUSE_OUTLINE |
                FAITH_FONTUSE_TRANSFORMABLE ;

strcpy (fat.szFaceName, "Helv") ;

GpiCreateLogFont (hps, NULL, LCID_CALFONT, &fat) ;
GpiSetCharSet (hps, LCID_CALFONT) ;

// Scale the font for the month and year name

lLength = sprintf (szBuffer, "%s %d", apszMonths[sMonth], sYear) ;
GpiQueryTextBox (hps, lLength, szBuffer, TEXTBOX_COUNT, aptlTextBox) ;
GpiQueryCharBox (hps, &szlfx) ;

szlfx.cx = szlCell.cx * szlfx.cx / aptlTextBox[TEXTBOX_COUNT].x * 7 ;
szlfx.cy = szlCell.cy * szlfx.cy / aptlTextBox[TEXTBOX_COUNT].y * 7 ;

szlfx.cx = szlfx.cy = min (szlfx.cx, szlfx.cy) ;
GpiSetCharBox (hps, &szlfx) ;
GpiQueryTextBox (hps, lLength, szBuffer, TEXTBOX_COUNT, aptlTextBox) ;

// Display month and year at top of page

ptl.x = (szlPage.cx - aptlTextBox[TEXTBOX_COUNT].x) / 2 ;
ptl.y = 6 * szlCell.cy - aptlTextBox[TEXTBOX_COUNT].y ;
GpiCharStringAt (hps, &ptl, lLength, szBuffer) ;

// Set font size for day numbers

szlfx.cx = szlfx.cy = MAXFIXED (min (szlCell.cx, szlCell.cy) / 4, 0) ;
GpiSetCharBox (hps, &szlfx) ;

// Calculate some variables for showing days in month

fLeap = (sYear % 4 == 0) && ((sYear % 100 != 0) || (sYear % 400 == 0)) ;
sExtraDay = fLeap && sMonth == 1 ? 1 : 0 ;

sDayStart = 1 + sYear - 1990 + (sYear - 1991) / 4 ;
sDayStart += asMonthStart[sMonth] + (fLeap && sMonth > 1 ? 1 : 0) ;
sDayStart %= 7 ;

// Loop through days

for (sDay = 0 ; sDay < asMonthLen[sMonth] + sExtraDay ; sDay++)
{
    ptl.x = (sDayStart + sDay) % 7 * szlCell.cx ;
    ptl.y = (5 - (sDayStart + sDay) / 7) * szlCell.cy ;
    GpiMove (hps, &ptl) ;

    ptl.x += szlCell.cx ;
    ptl.y += szlCell.cy ;
    GpiBox (hps, DRO_OUTLINE, &ptl, SL, SL) ;

    lLength = sprintf (szBuffer, "%d", sDay + 1) ;
    GpiQueryTextBox (hps, lLength, szBuffer, TEXTBOX_COUNT, aptlTextBox) ;

    GpiQueryCurrentPosition (hps, &ptl) ;
    ptl.y += szlCell.cy - aptlTextBox[TEXTBOX_COUNT].y ;
    GpiCharStringAt (hps, &ptl, lLength, szBuffer) ;
}

// Clean up

GpiSetCharSet (hps, LCID_DEFAULT) ;
GpiDeleteSetId (hps, LCID_CALFONT) ;
GpiRestorePS (hps, -1L) ;

```

```

VOID Message (HWND hwnd, SHORT sIcon, CHAR *pszMessage)
{
    WinMessageBox (HWND_DESKTOP, hwnd, pszMessage, "PrintCal",
        0, sIcon | MB_OK | MB_MOVEABLE) ;
}

VOID FAR PrintThread (THREADPARAMS *ptp)
{
    HAB hab ;
    HDC hdcPrinter ;
    HPS hpsPrinter ;
    SHORT msgReturn ;
    SHORT sMonth ;
    SIZEL szlPage ;

    hab = WinInitialize (0) ;

    if ((hdcPrinter = OpenDefaultPrinterDC (hab)) != DEV_ERROR)
    {
        // Create the presentation space for the printer

        szlPage.cx = 0 ;
        szlPage.cy = 0 ;
        hpsPrinter = GpiCreatePS (hab, hdcPrinter, &szlPage,
            PU_ARBITRARY | GPIF_DEFAULT |
            GPIF_MICRO | GPIF_ASSOC) ;

        GpiQueryPS (hpsPrinter, &szlPage) ;

        // Start the document

        if (DevEscape (hdcPrinter, DEVESC_STARTDOC,
            SL, "Calendar", NULL, NULL) != DEVESC_ERROR)
        {
            // Loop through months

            for (sMonth = ptp->cp.sMonthBeg ;
                sMonth <= ptp->cp.sMonthEnd ; sMonth++)
            {
                DisplayPage (hpsPrinter, &szlPage, ptp->cp.sYear, sMonth) ;

                DevEscape (hdcPrinter, DEVESC_NEWFRAMES,
                    SL, NULL, NULL, NULL) ;
            }

            // End the document

            DevEscape (hdcPrinter, DEVESC_ENDDOC, SL, NULL, NULL, NULL) ;
            msgReturn = WM_USER_PRINT_OK ;
        }
        else
            msgReturn = WM_USER_PRINT_ERROR ;

        // Clean up

        GpiDestroyPS (hpsPrinter) ;
        DevCloseDC (hdcPrinter) ;
    }
    else
        msgReturn = WM_USER_PRINT_ERROR ;

    // Post message to client window and end thread

    DoEnterCriticalSection () ;
    WinPostMsg (ptp->hwndNotify, msgReturn, 0, 0, ptp, NULL) ;
    WinTerminate (hab) ;
    endthread () ;
}

```

The PU prefix stands for "page units." Normally, when a program obtains a presentation space handle from WinGetPS or WinBeginPaint (with a NULL second parameter), the page units are pixels (PU_PELS). This means that a program draws on its window in units of pixels.

With pixels the horizontal and vertical resolutions of a device may not be equal. This is true both of the EGA display and of many dot matrix printers. The DisplayPage function scales the font by setting equal horizontal and vertical character-box sizes. If I were drawing in units of pixels, an equal horizontal and vertical character-box size would not necessarily translate into an equal horizontal and vertical size on the output device. The font would be distorted.

The PU_ARBITRARY page units take care of that little problem. GPI creates a transform (known as the *page viewport* transform) that allows a program to assume equal horizontal and vertical resolution. The units passed in GPI functions are then mapped by GPI into the pixels of the display or printer page.

During the WM_CREATE message, ClientWndProc also obtains the current year and month by calling DosGetDate-Time. The results are stored in a CALPARAMS structure, called cp, which is defined near the top of PRINTCAL.C.

When ClientWndProc receives a WM_SIZE message, the size of the window is reported in units of pixels. These must be converted to the selected page units of the PS, using GpiConvert. The re-

sult is saved in a SIZEL structure.

With everything now in place, WM_PAINT processing is simple. It begins with a call to WinBeginPaint, with the second parameter set to the PS handle. (If you want WinBeginPaint to obtain a cached micro PS, this parameter must be set to NULL; the function then returns the PS handle.) The GpiErase function erases the window. The PS handle, the size of the client window stored in the SIZEL structure, and the year and month stored in the CALPARAMS structure are passed to DisplayPage to show the month in the program's window.

MENUS AND DIALOG BOXES

The WM_COMMAND messages that ClientWndProc processes indicate that the

Environments

user has selected one of the two menu options: About PrintCal (the `IDM_ABOUT` command) or Print Calendar (the `IDM_PRINT` command).

For `IDM_ABOUT`, `ClientWndProc` calls `WinDlgBox`, using the `IDD_ABOUT` dialog box template (contained in the `PRNTCAL.RC` resource script shown in the last issue) and the `AboutDlgProc` dialog box procedure. This is a standard dialog box procedure for an About box.

For the `IDM_PRINT` command, `ClientWndProc` calls `WinDlgBox`, using the `IDD_PRINT` dialog box template and the `PrintDlgBox` dialog box procedure. Notice that the last parameter to `WinDlgBox` is a pointer to the `CALPARAMS` structure that initially contains the current year and month.

Let's now skip down to `PrintDlgProc` to see what goes on when the dialog box is invoked. During the `WM_INITDLG` message, the `mp2` message parameter is set to the last parameter of the `WinDlgBox` call that invoked the dialog box. This is the pointer to the `CALPARAMS` structure. The dialog procedure saves this pointer in the `pcpCurrent` variable and also copies it to the `cpLocal` variable. The text box and radio buttons in the dialog box are initialized with the year and month values of the `cpLocal` structure.

A `WM_CONTROL` message to `PrintDlgProc` indicates that a user has changed one of the radio buttons. This change is recorded in the `cpLocal` structure. When the user triggers one of the pushbuttons, `PrintDlgProc` receives a `WM_COMMAND` message. For the Print (`DID_OK`) and Preview (`IDD_PREVIEW`) buttons, the dialog procedure verifies that the selected year and months are valid; then it copies the values of `cpLocal` back to `pcpCurrent` (which points to the `CALPARAMS` structure stored in `ClientWndProc`).

`PrintDlgProc` then passes the button ID as the second parameter to `WinDismissDlg`, the function that destroys the dialog box. This parameter is returned from the `WinDlgBox` call in `ClientWndProc`.

If `WinDlgBox` returns `DID_CANCEL`, `ClientWndProc` is through processing the Print Calendar menu command and simply returns 0. Otherwise, the window procedure assumes that the user changed the year or month and so proceeds to invali-

POPMENU REVISITED

by Charles Petzold

The Environments column in the November 28, 1989, issue of *PC Magazine* presented a program called `POPMENU`, which displayed a pop-up menu whenever you clicked the right mouse button in the program's client window. `POPMENU` worked fine under OS/2 1.1. But when I got my hands on OS/2 1.2, I discovered that its operation wasn't quite right when running under the new version. The menu would pop up, but generally outside of the program's client window. It was supposed to pop up at the mouse pointer position.

So I did what any programmer working with the Presentation Manager can do when stuck on a problem: I posted a message in the Programming forum of PC MagNet, asking if anyone knew of a solution.

Within 36 hours, Paul Montgomery, a partner in AQL Systems (a company specializing in microcomputer-based real-time control systems), came up with the answer. In the `WinSetWindowPos` call during the `WM_BUTTON2DOWN` message, change the last parameter from

```
SWP_MOVE  
  
to  
  
SWP_MOVE | SWP_SHOW
```

That's enough to make the program work the same way under OS/2 1.2 as it does under OS/2 1.1. Paul went on to

suggest another change, however. Rather than use `WinSendMsg` to send the menu window an `MM_SELECTITEM` message, you can use `WinPostMsg` to post the menu window an `MM_STARTMENU` message, like this:

```
WinPostMsg (hwndMenuPopup,  
            MM_STARTMENU,  
            MPFROM2SHORT (TRUE, TRUE),  
            NULL) ;
```

This has two advantages over the earlier code. First, the call to `WinSetCapture` can be removed, since it's no longer needed. Second, a pop-up menu invoked in this way has a full keyboard interface. The key letters of the pop-up menu can be underlined, just as in a normal menu.

Larry D. Smith, another PC MagNet participant, suggested another change. He recommended that the menu window not be made a child of the client window (this will eliminate the `WinSetParent` call during the `WM_CREATE` message). This change makes the `WinQueryPointerPos` call during the `WM_BUTTON2DOWN` message unnecessary. Instead, the program can obtain the mouse pointer coordinates from the message parameter, as follows:

```
ptlMouse.x = SHORT1FROMMP (mp1) ;  
ptlMouse.y = SHORT2FROMMP (mp1) ;
```

The revised version of `POPMENU` has been uploaded to PC MagNet. ■

date the window with a call to `WinInvalidateRect`. This generates a `WM_PAINT` message to repaint the client window. If the user selected the Preview button (`IDD_PREVIEW`) from the dialog box, then `ClientWndProc` is done.

Otherwise, a print job is in the works. First, a structure of type `THREADPARAMS` must be allocated. This structure is defined near the top of `PRNTCAL.C`. It contains fields for the thread's stack, the handle of the client window, and a `CALPARAMS` structure for the selected year and month range.

The `_beginthread` function included in *Microsoft C*, Version 5.1, starts another thread of execution—in this case, the second thread. The thread begins at the `PrintThread` function. The last parameter to `_beginthread` is a pointer to the `THREADPARAMS` structure that contains the information the thread needs to print the calendar.

`ClientWndProc` then finishes processing the menu command by incrementing the value of `usActiveThreads` (a global variable defined near the top of `PRNTCAL.C` that I'll describe toward the end of



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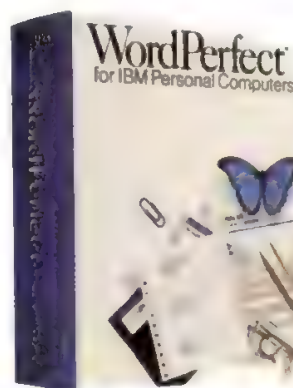
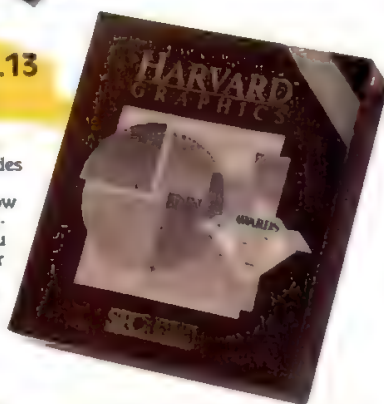
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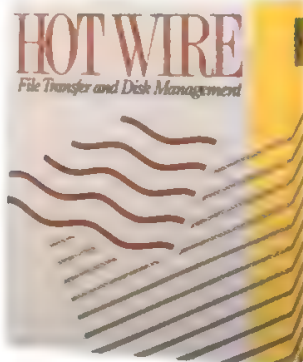


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Environments

this article) and by displaying the following in the message box: "Print job successfully started."

THE SECOND THREAD

The PrintThread function (located near the bottom of PRINTCAL.C) is now running concurrently with the rest of the program. The variable passed as the last parameter to `_beginthread` (in this case, a pointer to the `THREADPARAMS` structure) appears as a parameter to the thread function.

PrintThread obtains a handle to the device context of the default printer by calling `OpenDefaultPrinterDC`. This function is in the `PRINTDC.C` file I discussed in this column in our February 27, 1990, issue. A presentation space associated with the printer device context is created by calling `GpiCreatePS`. This call is basically the same as the call used to create a presentation space for the program's window.

The `SIZEL` structure passed as the third parameter to `GpiCreatePS` indicates the size of the presentation page, which is the drawing surface for the presentation space. By setting the two fields of the structure to zero, the program can obtain a default-size presentation page. The default size is equal to the size of the printable area of the page. A call to `GpiQueryPS` then obtains the real size of the page.

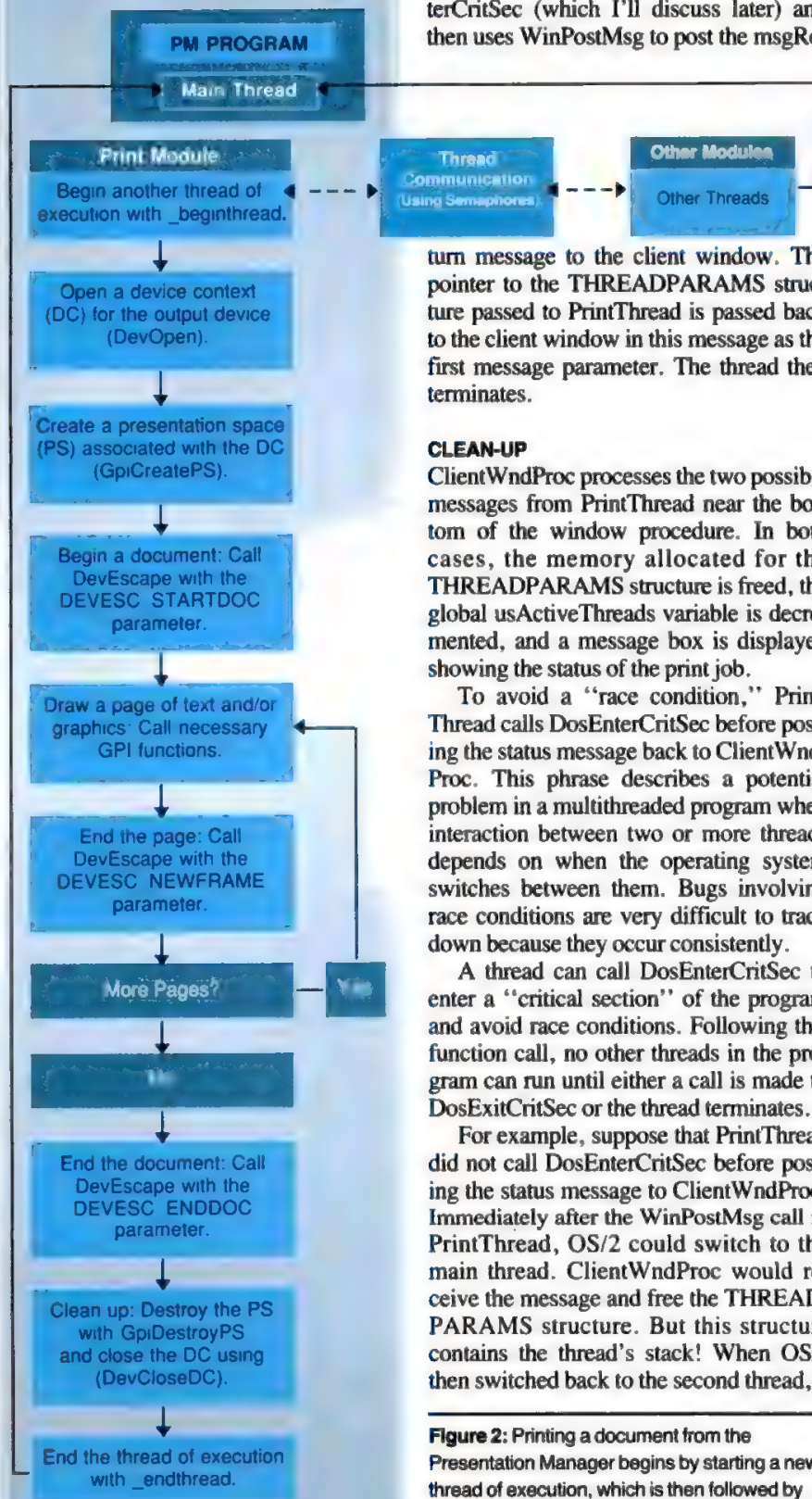
A call to `DevEscape` with the `DEVESC_STARTDOC` parameter begins the document. The `DevEscape` function is similar in concept to the `DosDevIOctl` function. It is used to pass information to (or obtain information from) a PM presentation driver. In the future, `DevEscape` could be used to access special features of the device that are not supported in GPI. `DevEscape` is customarily used today for controlling document printing.

A `for` loop cycles through the range of selected months. For each month, a call to `DisplayPage` prints the calendar on the page. This is followed by another `DevEscape` call (this time with the `DEVESC_NEWFRAME` parameter) to end the page and begin another. When all pages have been printed, a third `DevEscape` call (with a `DEVESC_ENDDOC` parameter) ends the document. `GpiDestroyPS` destroys the printer presentation space, and `DevCloseDC` closes the device context.

If all went well, the value of `msgReturn` in `PrintThread` is set to `WM_USER_`



HOW TO PRINT FROM PM



`PRINT_OK`; otherwise, it's set to `WM_USER_PRINT_ERROR`. These "user-defined" messages appear near the top of `PRINTCAL.C`. `PrintThread` calls `DosEnterCritSec` (which I'll discuss later) and then uses `WinPostMsg` to post the `msgRe-`

turn message to the client window. The pointer to the `THREADPARAMS` structure passed to `PrintThread` is passed back to the client window in this message as the first message parameter. The thread then terminates.

CLEAN-UP

`ClientWndProc` processes the two possible messages from `PrintThread` near the bottom of the window procedure. In both cases, the memory allocated for the `THREADPARAMS` structure is freed, the global `usActiveThreads` variable is decremented, and a message box is displayed showing the status of the print job.

To avoid a "race condition," `PrintThread` calls `DosEnterCritSec` before posting the status message back to `ClientWndProc`. This phrase describes a potential problem in a multithreaded program when interaction between two or more threads depends on when the operating system switches between them. Bugs involving race conditions are very difficult to track down because they occur consistently.

A thread can call `DosEnterCritSec` to enter a "critical section" of the program and avoid race conditions. Following this function call, no other threads in the program can run until either a call is made to `DosExitCritSec` or the thread terminates.

For example, suppose that `PrintThread` did not call `DosEnterCritSec` before posting the status message to `ClientWndProc`. Immediately after the `WinPostMsg` call in `PrintThread`, OS/2 could switch to the main thread. `ClientWndProc` would receive the message and free the `THREADPARAMS` structure. But this structure contains the thread's stack! When OS/2 then switched back to the second thread, it

Figure 2: Printing a document from the Presentation Manager begins by starting a new thread of execution, which is then followed by the steps shown here. These steps should be performed in a second thread of execution.

Environments

would have no stack. The program would quickly crash and terminate with a protection violation. Calling `DosEnterCritSec` ensures that the thread terminates before `ClientWndProc` frees the thread's stack.

The logic of `PRINTCAL` indicates that there aren't any problems (at least, none

that I know of!) in having several of these printing threads going simultaneously. A `THREADPARAMS` structure is allocated for each printing thread. A pointer to the structure is stored on the thread's stack. The thread returns the pointer to the window procedure so that the memory allocated for the structure can be freed.

Very often a programmer who begins a multithread programming exercise uses global variables for sharing data among

threads. This could cramp the flexibility of the program, however. Had I used global variables for the year and month range passed to the thread, I would probably have limited the program to supporting only one print thread at a time. As it is, the limits are imposed by the operating system and the multithread library, not by the `PRINTCAL.C` code.

PREVENTING TERMINATION

What happens if you terminate the `PRINTCAL` program while one of the printing threads is still active? Well, it's definitely not such a hot idea! An early version of `PRINTCAL` developed all sorts of strange problems if the main thread terminated before the printing thread. For example, if `PRINTCAL` was run from the command line and terminated while printing, I could never get back to the command line. The program seemed to have stopped working; however, the `PRINTCAL.EXE` file was locked.

The `usActiveThreads` variable is intended to avoid this problem. The variable is incremented whenever a printing thread is begun and decremented when a thread has terminated. In `PRINTCAL`'s main function, if a `WM_QUIT` message is fetched from the message queue (which causes `WinGetMsg` to return 0), the value of `usActiveThreads` is checked. If the variable is non-zero, `PRINTCAL` displays a message box saying the program can't be terminated. It then calls `WinCancelShutdown` and goes back into the message loop.

In the earlier version of the environment, `OS/2 1.1`, `WinCancelShutdown` halts a shutdown of the system initiated from the Task Manager. In `OS/2 1.2`, it works a little differently. It will halt a `Close` all command from the Desktop Manager, but it will not halt a `Shutdown` command. The shutdown carries through to completion regardless.

END OF JOB

Printing from the Presentation Manager certainly isn't as easy as using the old DOS BIOS interrupt 17h service. Then again, the printing of device-independent graphics in the background isn't exactly one of interrupt 17h's strengths.

As is typical in PM programming, I think the results are worth the effort. Adding printing to your Presentation Manager programs may not be easy, but when done right, it's something that you can be legitimately proud of. ■



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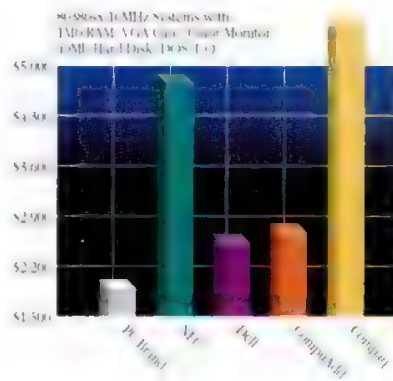
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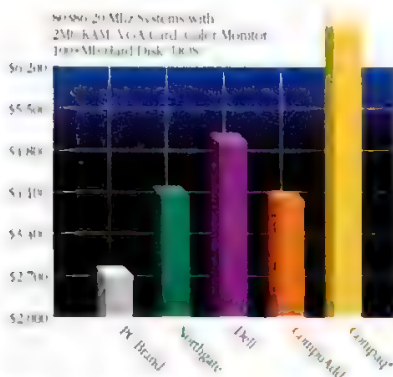
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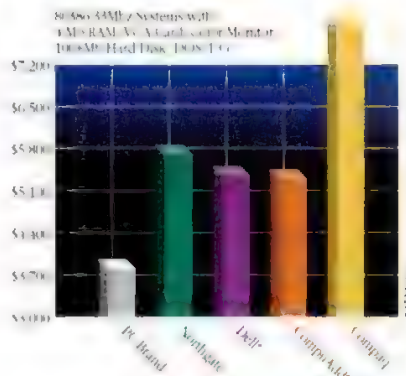
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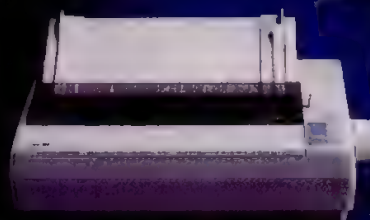
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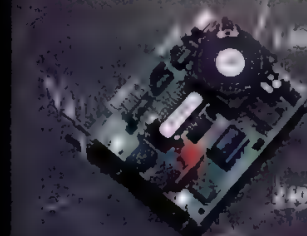
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by
Ray Duncan

Power Programming

Using Long Filenames And Extended Attributes, Part 1

Like the two OS/2 releases before it, OS/2 1.2 incorporates many major changes in its application program interface (API). In general, most changes—the manipulation of volumes, directories, and files—are related to mass storage. Specifically, new capabilities include file preallocation, multiple date and time stamps on files and directories, installable file systems—particularly the High Performance File System (HPFS)—long mixed-case filenames with embedded blanks and multiple dot delimiters, and extended attributes. That's a lot for the software developer to analyze and master.

After surveying the territory and poking gingerly into some of the new file system matters in the last two issues, the time has come to face the practical challenges OS/2 1.2 poses for programmers. Upgrading your current application source code for OS/2 1.2 is a multistep process that will require a fair amount of time and thought. It will also require several columns to cover the topic properly, so be patient, please!

THE HAVES AND THE HAVE-NOTS

The impact of long, free-form filename and extended attribute support on existing (OS/2 1.0, OS/2 1.1, and DOS) application programs presented the designers of OS/2 1.2 with two areas of concern.

First, virtually every existing program assumes that the name of a file cannot be longer than 12 characters: eight filename characters, a dot delimiter, and three extension characters. The program allocates its buffers accordingly. As another legacy from DOS, most of these programs assume that the maximum length of a directory pathname is 64 characters.

Given these assumptions, if APIs like `DosFindFirst`, `DosFindNext`, and `DosQCurDir` suddenly started to return longer filenames and paths—not to mention filenames with embedded blanks, mixed case, and multiple dot delimiters—you can predict that the filename parsing and display routines of existing programs would misbehave dramatically.

■ There's a lot to do when you have to modify an existing program or create one for OS/2 1.2. Here are the first steps, with sample programs to illustrate them.

Second, OS/2 1.0, OS/2 1.1, and existing DOS applications know nothing at all about the extended attributes supported by OS/2 1.2. The extended attribute facility, which allows free-form binary or ASCII information to be associated with a file but stored outside the file, is intended to serve as a foundation for a future object-oriented user interface. The rudiments of this interface are already present in OS/2 1.2's PM Shell, which can use the `.ASSOCTABLE` and `.TYPE` extended attributes to associate application programs and icons with data files automatically.

But for such an interface to fly, the extended attributes that have been bound to data files must *stay* attached. Since existing applications were written when extended attributes did not exist, they can't be expected to preserve and update the extended attributes appropriately.

To make the potential problems with extended attributes a bit more explicit, let's consider what happens with a typical text editor program. In such a program, one major design goal is to always let the user fall back to the previous version of his data file. He might, for example, make

some terrible error during an editing session, experience a power failure, or run into some other calamity.

The usual strategy is to create a temporary file, copy the existing data to the temporary file, and then perform all editing on the contents of the temporary file. When the user finally exits from the editor and indicates that he wants to save his changes, the program then deletes any preexisting `.BAK` file, renames the original file with the extension `.BAK`, and finally renames the temporary file to the original filename.

Following this scenario, however, the extended attributes associated with the original file would invariably be lost. The pre-OS/2 1.2 editor program doesn't know that the attributes exist, and the operating system has no obvious way to deduce (when the temporary file is created) that it needs to copy the extended attributes on behalf of the application.

Faced with this situation, our heroes at Microsoft and IBM decided to defend the operating system, file system, and user interface from existing application programs (and vice versa) by dividing the universe of application programs into two classes.

There are applications that declare themselves capable of handling long, free-form filenames and extended attributes, and on the other hand, there are those that do not. The *declaration* takes the form of a byte flag at offset 37h in the New EXE executable file header (this byte was previously defined as *reserved*). DOS applications that don't have a New EXE file header are naturally lumped into the *incapable* class. Additionally, the universe of

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extended attributes has also been divided into two classes: critical extended attributes and noncritical extended attributes.

Here's how the scheme works. When a real-mode program is running in OS/2's DOS compatibility environment or a protected-mode program is running the New EXE file header with 00h in the *long-name and EA-aware* flag byte, that program simply won't see any file whose name is not consistent with the FAT file system's 8.3 conventions. Program attempts to create or open a file with a long filename will fail, and any searches the program tries to conduct with DosFindFirst and DosFindNext will find only the subset of files with FAT-style names. Further, regardless of the nature of the filename, such a program will not see any file that has one or more critical extended attribute.

On the other hand, when a protected-mode program whose New EXE header has 01h in the *long-name and EA-aware* flag byte executes, it will have access to all the capabilities of the file system. It can create or open files with names including up to 254 characters, and those filenames can contain mixed-case letters, embedded blanks, and multiple dot delimiters. Such a program can also manipulate any file with extended attributes, whether or not they are critical attributes. The matrix of the possibilities for "old" and "new" applications is shown in Figure 1.

The *long-name and EA-aware* flag byte in the New EXE header of an application can be set in either of two ways. You can instruct the Linker to set it either with the NEWFILES directive or with the LONGNAMES modifier on a NAME directive in the application's module definition (.DEF) file, as illustrated in the following lines:

```
NAME MYAPP WINDOWCOMPAT LONGNAMES
```

```
.
```

```
OR
```

```
NAME MYAPP WINDOWCOMPAT  
NEWFILES
```

```
.
```

You can also use the MARKEXE utility program supplied with the *OS/2 Programmer's Toolkit*. In OS/2 1.2, MARKEXE



FILE ACCESS UNDER OS/2 1.2

	Filename in 8.3 Format	Filename in Non-8.3 Format
Critical EAs Present	Access not allowed	Access not allowed
No Critical EAs Present	Access allowed	Access not allowed

Figure 1: A matrix of the file-access possibilities for real-mode DOS and "old" protected-mode applications when running under OS/2, Version 1.2. An old application has 00h in the byte at offset 37h of the New EXE file header. A "new" application has 01h at offset 37h in the New EXE header and is assumed by the operating system to be able to handle extended attributes and long, free-form filenames properly.

has two new switches—LFNS and NOLFNS—whose usage is obvious.

UPGRADING YOUR PROGRAMS

The first step in adapting your program to OS/2 1.2 is to make your application live by the ancient medical school credo: "Above all, do no harm." In other words, if your program manipulates a file in any way, it must ensure that the extended attributes already associated with that file are at least preserved. Two new API functions in OS/2 1.2 are very helpful here: DosEditName, and DosCopy. DosEditName transforms one filename into another using an editing string. For example, if you feed DosEditName the strings "MYFILE.DAT" and "*.BAK," it will return the string "MYFILE.BAK." DosCopy duplicates a file or directory along with its extended attributes (if any).

By using DosCopy and DosEditName in a very simple procedure, your program can safely modify existing files, whether or not they have extended attributes. First, DosEditName is used with the original filename to build two new filenames: one for the final backup file and one for a temporary file. Next, DosCopy is used to duplicate the original file and give the duplicate the name of the temporary file. The application then opens, modifies, and closes the temporary file. Finally, any pre-existing file with the same name as the backup file is deleted, the original file is renamed as the backup file, and the temporary file is given the name of the original.

A simplified example of this strategy, in the form of the program EDITDEMO.C, is available on PC MagNet. I have used the extension \$\$\$ for the temporary file and BAK for the backup file. Once the

original file is duplicated, EDITDEMO uses the standard stream functions to open, read, write, and close the file. This latter procedure is actually somewhat risky if you are using any of the current versions of the Microsoft C compiler, for you must know for certain that the filename is not going to overflow the C runtime library buffers and structures set up by fopen. Presumably, the runtime library for Microsoft C, Version 6.0, will be able to cope a bit more gracefully with long, free-form filenames and extended attributes.

Once your program is past the stage of harm, you will want it to be able to *do* something: to inspect, add, or alter extended attributes as it creates or processes files. In particular, your program should always attach the .TYPE and .LONGNAME extended attributes to any file that it creates, and it should update these attributes on any file it modifies. At a minimum, all other extended attributes such as .VERSION, .KEYPHRASES, .HISTORY, and .ICON should also be preserved when a file is modified, although they are optional when a new file is being created.

API functions that manipulate extended attributes rely on three types of data structure, dubbed GEAList, FEAList, and EAOP. Once you've mastered these structures, you're on your way to using EAs successfully. The biggest problem with the structures is that they contain variable-length components, so a great many on-the-fly pointer calculations are required. If you're like me, you'll soon be forced to resort to *The C Programming Language* by Kernighan and Ritchie to rediscover how to defeat C's tendency to do "funny" things during structure pointer arithmetic.

A GEAList specifies the names of ex-

Power Programming

SHOWEA.C

1 of 2

```

/*
SHOWEA.C  A simple demonstration program for OS/2 version 1.2
that fetches and displays the extended attributes
associated with a file or directory.

Copyright (C) 1989 Siff-Davis Communications
PC Magazine * Ray Duncan

Compile:  cl /zi /F 2000 showea.c
         markexe lfns showea.exe
         markexe windowcompat showea.exe

Usage:   showea pathname
*/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <memory.h>
#include <malloc.h>

#define dim(x) (sizeof(x)/sizeof(x[0])) // number of elements in structure

#define EAT_BINARY      0x0fff0 // Length-preceded binary
#define EAT_ASCII      0x0fffd // Length-preceded ASCII
#define EAT_BITMAP      0x0fffb // Length-preceded bitmap
#define EAT_METAFILE    0x0fffa // Metafile
#define EAT_ICON        0x0fff9 // Length-preceded icon
#define EAT_EA           0x0fffe // ASCII EA of associated data
#define EAT_MVMT         0x0ffdf // Multi-value multi-type
#define EAT_MVST         0x0ffde // Multi-value single-type
#define EAT_ASN1         0x0ffdd // ASN.1 field

#define EABUF_SIZE      16384 // size of EA buffer
#define MAXPATHNAME      268 // maximum length of pathname
#define MAXFILENAME      255 // maximum length of filename

#define ERROR_BUFFER_OVERFLOW 111 // error code for DosQPathInfo

#define API unsigned extern far pascal // OS/2 API function prototypes
API DosQPathInfo(char far *, unsigned, void far *, int, unsigned long);

void showea(void); // local function prototypes
void fmtUNKNOWN(void);
void fmtBINARY(void);
void fmtASCII(void);
void fmtBITMAP(void);
void fmtMETAFILE(void);
void fmtICON(void);
void fmtEA(void);
void fmtMVMT(void);
void fmtMVST(void);
void fmtASN1(void);

struct _EA { // extended attribute header
    unsigned char flags; // critical flag etc.
    unsigned char nsize; // length of EA name (without null)
    unsigned vsize; // total size of EA value
    char name[1]; // EA name and value begin here
};

struct _EAvalue { // extended attribute value
    unsigned type; // EA value type
    unsigned size; // length of EA variable data
    char data[1]; // actual data begins here
};

struct _FEAList { // receives extended attributes
    unsigned long size; // total size of structure
    char data[1]; // extended attributes begin here
};

struct _EAOP { // used by DosQPathInfo
    void far *pGEAList; // pointer to GEAList structure
    void far *pFEAList; // pointer to FEAList structure
    unsigned long oError; // offset of error, if any
};

struct _Eatable { // lookup table of EA types
    unsigned type; // binary type indicator
    char *name; // descriptive text
    void (*formatter)(); // formatting routine
};

Eatable[] = {
    0, "unknown EA type", fmtUNKNOWN,
    EAT_BINARY, "length-preceded binary", fmtBINARY,
    EAT_ASCII, "length-preceded ASCII", fmtASCII,
    EAT_BITMAP, "length-preceded bitmap", fmtBITMAP,
    EAT_METAFILE, "metafile", fmtMETAFILE,
    EAT_ICON, "length-preceded icon", fmtICON,
    EAT_EA, "associated EA data", fmtEA,
    EAT_MVMT, "multi-value multi-type", fmtMVMT,
    EAT_MVST, "multi-value single-type", fmtMVST,
    EAT_ASN1, "ASN.1", fmtASN1,
};

char *fname; // pointer to qualified pathname
struct _FEAList *FEAList; // pointer to EA buffer
struct _EA *pEA; // pointer to individual EA header
struct _EAvalue *pEAval; // pointer to individual EA value

main(int argc, char *argv[])
{
    struct _EAOP EAOP; // holds pointers for DosQPathInfo
    int error; // error code from DosQPathInfo

    if(argc != 2) // check command line
    {
        printf("\nshowea: wrong number of parameters\n");
        exit(1);
    }

    FEAList = malloc(EABUF_SIZE); // allocate EA buffer and
    fname = malloc(MAXPATHNAME); // qualified pathname buffer

    if(!FEAList || !fname) // exit if not enough heap
    {
        printf("\nshowea: heap allocation error\n");
        exit(2);
    }

    EAOP.pGEAList = NULL; // initialize EAOP components
    EAOP.pFEAList = FEAList; // and buffer to receive EAs
    EAOP.oError = 0;
    FEAList->size = EABUF_SIZE - sizeof(unsigned long);

    if(error = DosQPathInfo(argv[1], // retrieve EAs using filename
        4, // info level 4 = get all EAs
        &EAOP, // buffer to receive EAs
        sizeof(EAOP), // size of buffer
        0L) // reserved
    {
        if(error == ERROR_BUFFER_OVERFLOW)
        {
            printf("\nshowea: EA buffer too small\n");
            exit(3);
        }

        printf("\nshowea: file or directory not found\n");
        exit(4);
    }

    // display full pathname
    DosQPathInfo(argv[1], 5, fname, MAXPATHNAME, 0L);

    if(FEAList->size == sizeof(unsigned long))
    {
        printf("\nshowea: no extended attributes found\n");
        exit(5);
    }

    printf("\nExtended attributes for %s:\n", strlwr(fname));
    printf("\nName\t\t\t\t\tType\t\t\t\t\tValue");

    pEA = (struct _EA *) FEAList->data; // point to first EA
    while((char *) pEA < (FEAList->data+FEAList->size-sizeof(unsigned long)))
    {
        (char *) pEAval = // point to EA value
            pEA->name + pEA->nsize + 1;

        showea(); // display this EA name & value

        (char *) pEA = // go to next EA
            pEA->name + pEA->nsize + pEA->vsize + 1;
    }

    puts(""); // extra blank line

    /*
    SHOWEA: format and display current extended attribute.
    */
    void showea(void)
    {
        int i; // scratch variable
        i = findtype(pEAval->type); // look up the EA type

        printf("\n%-10.10s %-25.25s ", // display EA name, value type
            pEA->name, Eatable[i].name);

        (*Eatable[i].formatter)(); // call type-specific routine
        // to display EA value
    }

    /*
    FINDTYPE: look up extended attribute type in Eatable.
    */
    int findtype(unsigned EAtype)
    {
        int i; // scratch variable
        for(i = 1; i < dim(Eatable); i++) // skip dummy entry Eatable[0]
        {
            if(Eatable[i].type == EAtype) // if we matched EA type
                return(i); // return Eatable index
        }

        return(0); // no match, return 0
    }

    /*
    The routines below perform formatting and output of the value
    for each EA type. In this version of the demo program only
    the length-preceded ASCII, length-preceded simple binary, and
    multi-type multi-value types are implemented.
    The remainder are dummy functions that do nothing.
    */

    void fmtUNKNOWN(void) // unknown EA type
    {
        fmtBINARY();
    }

    void fmtBINARY(void) // length-preceded binary
    {
        int i; // scratch variable
        for(i = 0; i < min(8, pEAval->size); i++) // display binary data
    }

```

Figure 2: SHOWEA.C is the source code for a simple program that demonstrates how to fetch the extended attributes associated with a file or directory and format them for display. The program makes use of DosQPathInfo's ability to qualify a filename.

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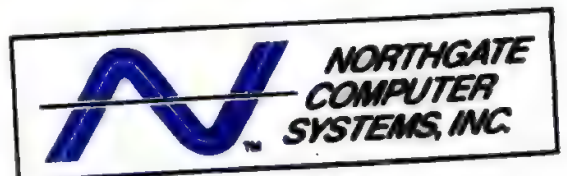


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Power Programming

SHOWEA.C

2 of 2

```

    printf("%02X ", pEAval->data[i]);
    if(pEAval->size > 8) printf("..."); // indicate there is more
}

void fmtASCII(void) // length-preceded ASCII string
{
    printf("%s", pEAval->data);
}

void fmtBITMAP(void) // length-preceded bitmap
{
    fmtBINARY();
}

void fmtMETAFILE(void) // length-preceded metafile
{
    fmtBINARY();
}

void fmtICON(void) // length-preceded icon
{
    fmtBINARY();
}

void fmtEA(void) // ASCIIZ extended attribute
                // name of associated data
{
    printf("%s", (char *) pEAval->data);
}

void fmtMVT(void) // multi-value multi-type
{
    int i;
    int fields;
    strcpy(pEA->name, "");
    fields = *((int *) (pEAval->data)); // retrieve number of fields
    (char *) pEAval = pEAval->data + sizeof(int); // point to first field

    for(i = 0; i < fields; i++) // loop across value fields
    {
        showsa(); // display this value field
        (char *) pEAval = pEAval->data + pEAval->size; // point to next value
    }
}

void fmtMVS(void) // multi-value single-type
{
    return;
}

void fmtASNI(void) // ASCII field
{
    return;
}

```

tended attributes that the program wants to retrieve. It begins with a double word that contains the length of the entire structure, followed by the names of one or more extended attributes. Each extended attribute name is in the form of a count byte, followed by an ASCIIZ string; the value in the count byte does not include the terminal null. A valid GEAList would be

```

GEAList dd 18
        db 5
        db '.TYPE',0
        db 5
        db '.LONGNAME',0

```

An FEAList holds or receives complete EAs, depending on whether the program is querying or modifying EAs. Like a GEAList, an FEAList begins with a double word that contains the length of the entire structure (if setting EAs) or of the available buffer (if getting EAs). The actual EAs follow, usually in the order in which they were originally assigned to the file. For instance, if your program is fetching the EAs for one of its data files, it first creates an empty FEAList such as

```

FEAList dd 4096
        db 4092 dup (?)

```

The system will then place the file's EAs (if any) into the buffer and will update the double word at the start of the buffer to reflect the actual amount of EA data returned.

As you'll recall from the last issue, the internal structure of an individual EA can be rather complicated. It is composed of a

flags byte (bit 7 if this byte is the "critical EA" flag), a byte containing the length of the EA name (not counting the terminal NULL), a word containing the length of the EA value, the EA name as an ASCIIZ string, and the EA value. This value is made up of a type word, a length word, and one or many bytes of variable data.

Here is an actual example of a simple .TYPE EA:

```

db 00H ; flag byte
db 5 ; length of EA name
dw 8 ; length of EA value
db '.TYPE',0 ; EA name
dw 0fffdh ; EA value type
dw 4 ; EA value data length
db 'Icon' ; EA value data

```

Note that this extended attribute pattern, .TYPE=Icon, is assigned by the Icon Editor in the *OS/2 Programmer's Toolkit* to any icon bitmap file it creates or edits.

Finally, the EAOP structure is composed of two pointers and a double word offset:

```

dd GEAList
dd FEAList
dd 0 ; error offset

```

The first pointer is the address of a GEAList structure, that is, a list of the names of EAs that the program wants to retrieve. The second pointer is to an FEAList buffer that receives extended attribute data on a "get" function or contains a list of EAs and their values on a "set" function. The final double word is filled in by OS/2 with an offset if it detects some inconsistency in

the GEAList or FEAList structures.

With the necessary EA structures in hand, you must start to tune up the spots in your program where you make or open files or create directories. The API functions to look at first are DosOpen2, DosMkDir2, DosFindFirst2, DosEnumAttribute, DosQFileInfo, DosSetFileInfo, DosQPathInfo, and DosSetPathInfo. These functions are involved with EAs in some way, and all are new in OS/2 1.2. (DosQFileInfo and DosSetFileInfo were in earlier versions, but in much weaker forms.)

DosOpen2 and MkDir2, nearly identical to the old DosOpen and DosMkDir, let one or more EAs be associated with a file or directory when it is created. As far as their parameters go, the functions differ from their predecessors only in that they require a pointer to an EAOP structure.

Like its DosFindFirst ancestor, DosFindFirst2 works in concert with DosFindNext and DosFindClose, but it also needs the address of an EAOP structure. DosFindFirst2 returns selected extended attributes along with the other file information that results from a successful search. It does not, however, use extended attributes to limit the search; any additional qualification of each matched file using extended attribute information must be done at the application program level. (I'll discuss the use of DosOpen2, DosMkDir2, and DosFindFirst2 in more detail in a future issue.)

The function pair DosQFileInfo and DosSetFileInfo are symmetric with the function pair DosQPathInfo and DosSetPathInfo in several ways. Each of the functions has a number of subfunctions to get or set file date and time stamps, size infor-

Power Programming

mation, individual extended attributes, or the entire battery of extended attributes associated with a file or directory. Interestingly, even though it is used by Microsoft's own software, the information level 4 subfunction, which reads or writes EAs as a complete set, is undocumented in the Microsoft *OS/2 Programmer's Reference Volume IV*.

DosQPathInfo also has two unique subfunctions (information levels 5 and 6) that can be extremely useful in just about every application program. For one thing, it will accept a filename with a partial or absent path component and return a fully qualified filename that includes the drive identifier and complete path from the root directory. For another, it can test whether a given file specification is valid for the specified or default volume. It's too bad the OS/2 developers didn't throw in a filename parsing function and regular expression matcher while they were at it!

The DosXFileInfo and DosXPathInfo function pairs differ in one very important respect. The DosXFileInfo functions work with a file handle. They are thus most appropriate for use in a program in which you are going to open a file and read or write its contents as well as modify its extended attributes. The DosXPathInfo functions, on the other hand, select a file or directory by its name. They are therefore most appropriate for use in simple extended attribute manipulation utilities (such as the EA-UTIL.EXE program supplied with OS/2 1.2), user interfaces (such as the PM Shell), or disk browsers.

In order to demonstrate the rudiments of extended attribute handling, I've written a simple program called SHOWEA.C (listed Figure 2) that fetches and displays the EAs associated with a file or directory. The program uses both DosQPathInfo's subfunction to query EAs based on a pathname and its ability to generate a fully qualified pathname. Instructions for compiling, linking, and using the demo program are in the listing.

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CIRCLE 158 ON READER SERVICE CARD

by
Craig Stinson

Spreadsheets

A SPREADSHEET PRO

In this column, I'll continue where I left off last time, with a description of Borland's new spreadsheet, *Quattro Pro*. The last column dealt with *Quattro Pro*'s overall style, user interface, and file-linking features. This time I'll take up some of the graphics, database, and macro components of the program. Overall, my aim is to help you decide which spreadsheet program to adopt and to let you assess how your current program stacks up against *Quattro Pro*.

THE GRAPHING ADVANTAGE

Graphing is an area in which *Quattro Pro* more than excels (pardon the pun). The program may rival or even surpass *Microsoft Excel* in breadth of graphing capability; yet *Quattro Pro* remains similar to *Lotus 1-2-3* in the way it chooses graph types, specifying data ranges, selecting options, and viewing the end product. If you can generate a graph in *1-2-3*, you can produce one in *Quattro Pro*.

Unlike both *1-2-3* and *Excel*, however, *Quattro Pro* lets you plant as many graphs as you like directly on your worksheet. Simply choose /Graph | Insert, tell the program which graph to insert, and specify a worksheet range. To remove the graph, you use /Graph | Hide.

In text mode, the display will show only a solid block of color or shading to indicate the graph's position. But if you're running the program in graphics mode—which requires an EGA or VGA display—you'll see the actual graph right on the worksheet. *Quattro Pro* automatically updates the graph in response to worksheet changes. And whichever mode you're using, the graphs appear on paper exactly where you put them on the worksheet.

By default, *Quattro Pro* maintains a 4:3 width-to-height ratio when drawing graphs on the worksheet; if the designated location has a different aspect ratio, then the graph will simply "float" within the range. However, you can tell the program to stretch the graph vertically or horizontally to fill your range. This is extremely

■ **A SPREADSHEET PRO:**
This second of two columns on *Quattro Pro* investigates the database, macro, and graphing—as well as graphics—capabilities of the new spreadsheet.

useful, because it lets you redraw the graph in the proportions that best serve your data.

Quattro Pro's file-linking capabilities allow graphs to use data in external worksheets. Unfortunately, because the program doesn't have true three-dimensional capability, all points in a given data series have to be in the same worksheet. So you can't create a cross-sectional series that uses the same cell location in each of many separate files—as you can in Release 3.

Quattro Pro, like *1-2-3*, Releases 2 and 3, also lets you create a fast graph from a block of data without specifying individual data series. *Quattro Pro* makes intelligent choices about which dimension of the block represents data points and which represents series.

Last but not least, *Quattro Pro* graphing offers a couple of important customizing options: the ability to use two separately scaled y-axes is especially handy in mixed-type graphs, and you can also use logarithmic scaling for any axis.

GRAPHS IN ALL SHAPES AND SIZES

Quattro Pro offers a variety of graph types—bar, x-y, stacked bar, pie, area, rotated (horizontal) bar, column, high-low-open-close, and text. You can even create mixed-type graphs, such as a line chart over a bar chart.

Two less-common options are the column and text graphs. A column graph is what some other programs call a pie-bar. To get a clear picture of this option, imagine a pie chart squeezed into a vertical bar, with each slice filling its appropriate per-

centage of the bar's height, and you have a column graph. Although the *Quattro Pro* manual suggests that column graphs provide more room for labels than pie graphs, I'm not convinced. I find that labels are more likely to overlap on a column graph than on a pie graph, since the program prints all labels to the left of the column instead of staggering them.

What *Quattro Pro* calls a text graph is in fact not a graph at all, but rather a blank tablet that you may fill with text. You can turn these text graphs into presentation slides or title screens for macro-driven applications with the help of *Quattro Pro*'s extensive font options and its built-in set of drawing tools, known as the Annotator.

PRESENTATION ENHANCEMENTS

Quattro Pro's Annotator is a miniature drawing package built into the spreadsheet. When used in conjunction with the text graph, mentioned above, this presentation tool will create support material such as bulleted lists, maps, logos, or whatever else pleases your fancy.

But the Annotator is not limited to the text graph; it allows you to add text—in any supported font, style, and size—anywhere on any graph; adjust the position of graph elements (if you don't like the spot *Quattro Pro* picked for your legend, just pick it up and move it); or add arrows and other symbols to emphasize the message(s) you want your graph to convey. Note that any text or symbol can be linked to any point, so if the data changes, you won't be left with an arrow pointing to nothing in particular.

The Annotator includes a clipboard facility that allows images created in one graph to be copied or moved to another and sized to fit the new location. Clipboard contents can also be saved to disk (in a proprietary .CLP format) and imported repeatedly. So if you have the artistic wherewithal to concoct a company logo with the Annotator, you can drop the logo into any slides generated with *Quattro Pro*. Marketing Graphics, of Glen Allen, Virginia,

Spreadsheets

sells libraries of clip-art images in .CGM and .PCX format, along with a .CGM-to-.CLP translator. With the help of this translator, you can import .CGM files generated in other programs into *Quattro Pro*.

Invoking the Annotator is simple. Just display the graph you want to enhance, then press the slash key. *Quattro Pro* redraws your graph in a somewhat smaller size and fills out the rest of the screen with drawing paraphernalia—a “toolbox,” a “property sheet,” a “gallery,” and an area for system messages. The toolbox includes tools for entering boxed text, arrows, lines, ellipses, and polygons. The property sheet adjusts to display choices—such as color, pattern or font—that are available for the current tool; the exact choices depend on the tool selected. The gallery displays all the options available for the current property. Figure 1 illustrates the power of the Annotator.

If your expertise is numbers, and you don't know a jointed line from a rounded rectangle, you won't turn out stunning graphs in your first session with the Annotator. And until you get the hang of it you may find yourself turning perfectly decent—if not fully enhanced—graphs to mush. But with patience and a bit of talent (or a good art department), *Quattro Pro*'s Annotator can help you produce superb presentation graphics.

Quattro Pro also includes an easy-to-use slide-show generator. Simply set up a two-column list: one column names the graphs you want to display and the other

lists the number of seconds each one should remain on-screen. If your presentation may be interrupted by questions from your audience, a zero value or a blank cell in the second column will keep the associated graph visible until you press a key.

DATA MANAGEMENT FEATURES

The database capability of *Quattro Pro* offers a few advantages over that of *1-2-3*, Release 2.2. Like *Quattro* 1.01, the latest Borland spreadsheet sorts on as many as five keys. However, *Quattro Pro* can also query a set of data stored in an external *Quattro Pro* file; and more important, it can query disk-based data stored in a *dBASE*, *Reflex*, or *Paradox* files.

To specify an external file as an input block for extracts and searches, follow the syntax requirements for any other kind of external cell reference: enclose the name of the external file in square brackets, and then specify the range of cells to be queried. Include the full path of the external file if it's not in the current directory.

When querying an external *Paradox*, *dBASE*, or *Reflex* file, you must specify a range of cells as an input block, even though you're working with the entire external file and the file doesn't know anything about cell addresses. This requirement simply serves the cause of uniform syntax; the required range reference can be anything encompassing two or more rows (for example, A1..B2).

Right now, *Quattro Pro* has broader external database capabilities than *1-2-3*, Release 3, which can interact only with *dBASE* files. That situation may change in the near future, however, as third-party DataLens drivers for Release 3 arrive.

MACROS: A CHOICE OF FORMATS

Like *1-2-3* and most other spreadsheet programs, *Quattro Pro* stores macros in worksheet ranges, executing the instructions in each row of the range until it encounters a {quit} command or a blank cell. If the range name is a backslash followed by a letter, you can execute the macro by simultaneously pressing Alt and the specified letter. Otherwise, you can choose it from a list of defined range names. You can record macros or enter them by hand. But before you use either method, you must make a decision: keystrokes or command equivalents.

Quattro Pro allows—even expects—its users to switch menu trees occasionally. This flexibility requires that the macro interpreter recognize menu commands in two forms: actual keystrokes and command-equivalent statements. For example, the /File | New command can be entered either as /fn or as { / View;New-Window}; the latter form is the “command equivalent” of the former.

If you write macros that will be used by other *Quattro Pro* users, some of whom will stick with the native menu tree while others switch to the *1-2-3* tree, you must record the macros in command-equivalent form. Macros written using command-equivalent statements are independent of menus and consequently run equally well under any of *Quattro Pro*'s three supplied menu trees, as well as any you could create with the program's undocumented Menu Builder utility. On the other hand, command-equivalent statements render macros unusable outside *Quattro Pro*. So, if you are planning to create macros compatible with both *1-2-3* and *Quattro Pro*, turn on the *1-2-3* menu tree and record your keystrokes.

MACRO FEATURES

As do most other spreadsheet programs that allow several files in memory at once, *Quattro Pro* permits and encourages you to build worksheet-independent macro libraries. When you execute a macro, the program tries to find that macro in the current worksheet. If the macro isn't there, each other sheet in memory is searched. The program runs the instructions in the first matching range it finds. *Quattro Pro* will let you designate a particular worksheet to be a macro library with the /Tools | Macro | Library | Yes command. If you choose this option, the program searches the current sheet first, then the library file—if it's in memory—and finally

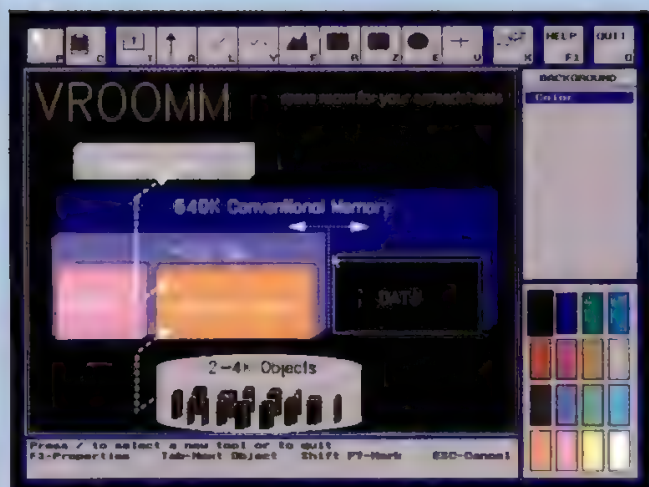


Figure 1: *Quattro Pro*'s Annotator can combine text with geometric shapes and freehand drawings to form effective presentations.

Spreadsheets

all the other files in memory.

External macros, whether in a library or some other file in memory, behave as you would want them to: cell addresses in formulas and commands affect the current worksheet, while addresses used as macro command arguments (for example, in {branch} instructions) refer to the file where the macro is stored. To make an external macro command refer to an address in the current worksheet, use *Quattro Pro's* file-linking syntax with an empty pair of brackets. For example:

```
{branch { }NEXTCELL})
```

Quattro Pro's macro language is comparable to that of *1-2-3*, Release 2.2. It offers everything available in the Lotus program except {frameoff}, {frameon}, {graphoff}, {graphon}, and {system}. The absence of these commands is regrettable, but *Quattro Pro* includes a few command and function amenities not present in any version of *1-2-3*. Most useful, I find, are @CURVALUE, {message}, and {graphchar}.

The @CURVALUE function lets a macro test for the current setting of any *Quattro Pro* menu command (the current print range, for example). With @CURVALUE, you can do such things as give the current file a new name based on the name it was last saved under.

The {message} command displays a boxed message at a specified screen location for a specified period of time. If the time argument is 0, the message stays on-screen until the user presses a key.

{graphchar} captures the keystroke pressed to remove a graph or a {message} display. Use {graphchar} with *Quattro Pro's* text graphs to create gorgeous help systems and full-screen menus.

A BUILT-IN DEBUGGER

Like *Quattro 1.01*, *Quattro Pro* includes a built-in debugger that should be the envy of every serious *1-2-3* application developer. To activate the debugger, you press Shift-F2. Then, as soon as you begin executing a macro, *Quattro Pro* opens a debug window at the bottom of the screen. The debug window shows three lines of macro code—the currently executing line, the previous line, and the following line. To step through the macro, press the Spacebar or click the mouse; to resume

full-speed execution, press Enter.

If you press slash while the debugger is running, a special menu pops up and offers you the following options: specify up to four breakpoint cells; specify up to four cells containing conditional break formulas (logical formulas, such as +A3>99; when the formula becomes true, the macro stops), specify up to four trace cells, abort macro execution, and edit a macro cell. If you specify trace cells, another window opens to display the values of your trace cells at each step in the macro's execution.

THE DIFFICULT QUESTION

So is this the spreadsheet for you? As usual, it depends. In terms of memory, discussed last time, *Quattro Pro's* on-line capacity of about 8.5MB doesn't touch *1-2-3*, Release 3's, 48MB memory maximum. If your memory requirements are extremely large, you may want to jettison DOS and opt for OS/2 programs like *Wingz*, *Excel* and again, Release 3.

Another possible disadvantage of *Quattro Pro* is a missing third dimension. If you want to manipulate ranges that encompass more than a single two-dimensional grid, this isn't the spreadsheet for you. Check out *1-2-3*, Release 3, *SuperCalc5*, and *VP-Planner 3D*.

Only your needs can determine whether *Quattro Pro's* database capability is a strength or a weakness. If you must use an external database, note that *Quattro Pro* supports only *dBASE* and Borland's own database products. Lotus and Microsoft may offer more general solutions.

But for most spreadsheet work, *Quattro Pro* is a powerful, economical, and elegant program. It's fast, its graphics are superb, its publishing capabilities are stronger than those of *Lotus 1-2-3* with *Allways*, and, considering all the spreadsheets, I think it has the most versatile and flexible file-linking system. It also reads and writes .WK1 files as comfortably as its own format, so it can be dynamically linked to *Microsoft Word* and *WordPerfect*. As of this writing (December 1989), it's definitely the most attractive Lotus-clone on the market.

HINTS, TIPS, QUESTIONS

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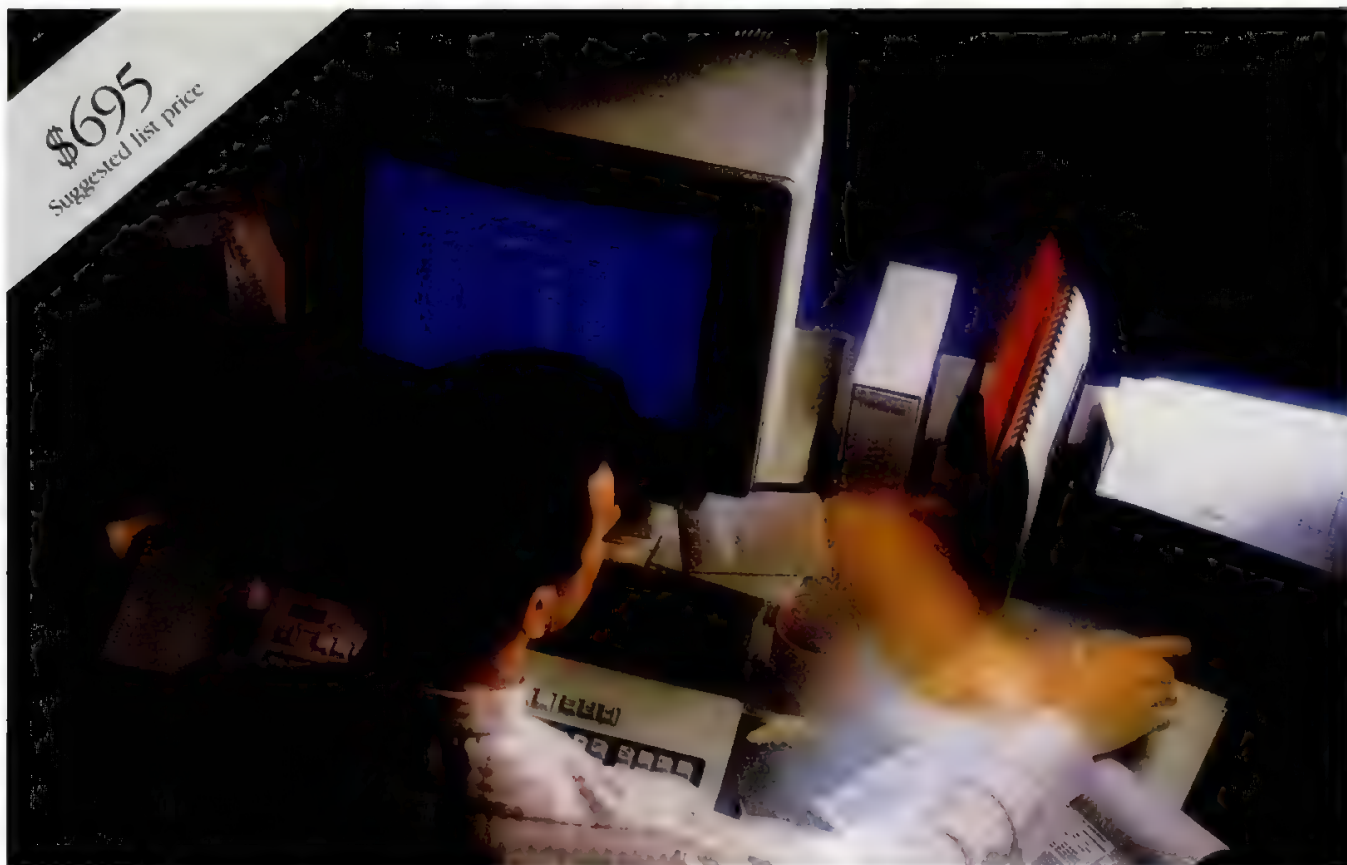


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by
Craig L. Stark

The Working Word

HIGH-POWERED WORD PROCESSING

Protest as I may against the hard-to-read screen display of *Word for Windows*, the fact remains that the program is going to be used in many an office. So I'm happy to report that you can significantly improve upon the *Windows*-supplied screen fonts by generating your own, using the font outline packages and Installation Kits put out by Bitstream. If you're fussy (like me), you can even hand-edit the Bitstream screen fonts by producing them from the outlines with SoftCraft's *WYSIfonts* and *Font Editor* programs.

One necessary warning: after installing any of these non-Microsoft screen fonts, you must be sure to comment-out those lines in your WIN.INI file that contain the names of your original *Windows* fonts. Simply put a semicolon at the beginning of each appropriate line. If you don't do this, the Microsoft fonts will take precedence over the ones you want to use.

The readability issue aside, however, it's worth looking more closely at some of the high-powered features that make *Word for Windows* so impressive.

MOUSE MERRY-GO-ROUND

Graphical interface programs are by nature more hospitable to those who would rather use a mouse than a keyboard. *Word for Windows* is no exception: to do without the mouse you have some 194 keystroke-equivalent commands to learn, including such beauties as Ctrl-Shift-F12 to print a file.

But *Word for Windows* has done some intelligent things to silence the usual complaints of the keyboard curmudgeons. The latter often grouse that for commonly needed formatting operations you must frequently move the mouse pointer to a menu item and click, then click again to select a second-level menu, and then line up a paper-thin *insertion point* with a specific field and type in a number. That's more work than typing a command.

Microsoft's answer to this is shown in

■ **HIGH-POWERED WORD PROCESSING:** *Word for Windows* has a ribbon and a ruler to simplify most formatting chores, and a macro language to help with the rest.

Figure 1, in the form of a *ribbon* and a *ruler*. These are displayable strips above your text, and both are chock-full of easy-access formatting icons. You select a block of text, be it a single character or your whole document, and at the ribbon you can instantly change its font, point size, and text attributes. You see the actual result of a change as soon as you deselect the marked area. Additionally, double-clicking a *hot spot* (a non-icon area) on the ribbon brings up the full character-formatting dialogue box, which you could otherwise select via the regular Format choices at the top of the screen.

Below the ribbon, the ruler similarly presents your paragraph-formatting choices. Again, you can double-click a hot spot, bringing up the full paragraph-format dialogue box. The ribbon and/or the ruler

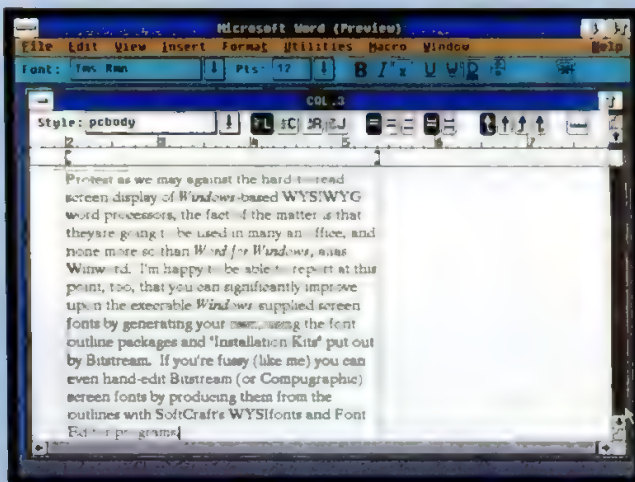
(as well as a 25th-line status bar) can be displayed or not, so when you don't need them you can see that many more lines of your text on the screen. Even a devout command-line disciple must admit that for all but rarely issued formatting commands, these make the mouse as easy to use as the keyboard.

MACROMANIA

Time was when the ability to save a selected portion of text, then get and insert it anywhere in any document, was a marvel. Today, text macros are supported by all but the most primitive editors. Next came the ability to include program *commands* within macros, so that with a keystroke or two you could, for example, reduce the margins and switch to single-spacing for an indented quotation set in a double-spaced article. A comparable macro would then return you to your normal formatting. Frankly, I suspect that for 90 percent of all straight word-processing needs, this much macro flexibility is enough.

The remaining 10 percent, advanced macro needs, require the use of at least some programming tools: defined variables, GOTO *label* techniques, IF/THEN statements, Boolean operators, and the like. In recent years, heavy-duty word pro-

Figure 1: By displaying the "ribbon" (upper) and "ruler" (lower) strips above your text you can vastly simplify issuing formatting commands in *Word for Windows*.



The Working Word

processors such as *XyWrite*, *WordPerfect*, and *Word* have all added programming language capabilities. Typically, these allow you to record the keystrokes that enter the text and commands that make up your (usually short) program. When you edit (a kinder word than debug) such program macros, their commands usually appear on-screen sandwiched between the chevron characters (« »).

Word for Windows has taken the next logical step by making its advanced-macro functions a subset of QuickBASIC, known, appropriately, as WordBASIC. This gives it an ability to dimension arrays, create and interact with dialog boxes, use Case statements, and link the program dynamically with other *Windows*-based applications. At the same time, a vastly expanded category of fields has been added. A field is a coded instruction inserted into your text that can be updated as needed and accessed via the macro language.

All this adds enormous power—a new dimension, really—to what we have become accustomed to thinking of as a macro programming language. At the same time, it tremendously steepens the learning curve. The discussion of fields alone takes 21 pages in the program's User's Reference and another 44 in the Technical Reference. But because fields are used for such everyday functions as inserting "Page x of y pages" in a header or footer, you can't simply ignore them even if you have no need to index your documents or link them to other applications.

Moreover, in the process of adding so

much advanced macro power, the relatively simple "within the chevron" macro-entry and -editing capabilities have been eliminated. When writing advanced *WordPerfect* macros, Neil Rubenking regularly used to remind readers that, whether they knew it or not, they were actually writing short programs. For anything that goes beyond what you can record as a straightforward series of keystrokes, *Word for Windows* will leave you in no doubt about the matter! The power that Word-BASIC brings to word processing is impressive.

THE CASE FOR FRACTIONS

One relatively simple example of *Word for Windows*'s macro language—and of its use of field codes and graphics orientation—was submitted by mathematician and frequent contributor to *PC Magazine* Barry Simon, and is shown in Figure 2. In a character-based word processor, it's not easy to enter a fraction in which the numerator appears above the denominator with a line in between. You'd probably start by putting a hard return on the line above your fraction and a second return to create space for the numerator. You'd then type a series of ASCII 196s (centered em dashes) for the divisor line, and terminate this line of type with two more hard returns. Then you'd enter the numbers above and below the fraction line. You'd probably put the numerator in subscript mode and the denominator in superscript mode so they'd come closer to the line. More likely, you'd settle for typing 512/643 and forget about its appearance!

Simon's macro code is shown in the right-hand window of Figure 2, and the instructions for using it are in the left-hand

window. The results are far more elegant and more easily obtained than you'd likely achieve with a character-based word processor. Because of its use of field codes, however, the macro must be entered in Macro Edit mode rather than as a simple series of recorded keystrokes. This is the point at which many word-processor users who can informally program in their application's macro language will find it necessary to grow beyond their previous limits. Rest assured that the final results will be well worth the additional effort.

DASH IT ALL

Another tip suggested by Simon was to make a glossary entry to select the kind of dash you need—a hyphen/minus sign, an en dash, or an em dash—by successively pressing a single key (F3).

To create the glossary entries, start with a fresh document, turn NumLock on, hold down the Alt key, and type in 0151. Select the character that is displayed on the screen (a medium-size en dash) and invoke Glossary from the Edit menu. Name the glossary entry -, using the minus sign (hyphen). Next, enter Alt+0150 in the document, select it, and name the macro Alt+0151. This name will display in the Name dialog as a box, but it will really be an en dash. Finally, type a regular minus sign in the document, select it, and define it as the glossary entry Alt+0150. Now Save All from the file menu.

Now when the cursor is just to the right of a hyphen or minus sign in your document (normally, just after you've typed it), the Glossary key (F3) will successively cycle among the three choices. You could use a similar scheme for cycling through the four kinds of smart quotes. This obviates the task of trying to remember the code numbers in the ANSI character set used by *Windows*. While the differences between the three successive entries will not show up in Display Mode, with regular typefaces the improvement adds a very professional touch, both on-screen and at the printer output.

TIPS FROM WORKING WORDSMITHS

Tell us your latest word-processing tips and we'll pay you \$50 for any we print. Please send your letter on a disk along with a printout. Mail your contributions to The Working Word, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). ■

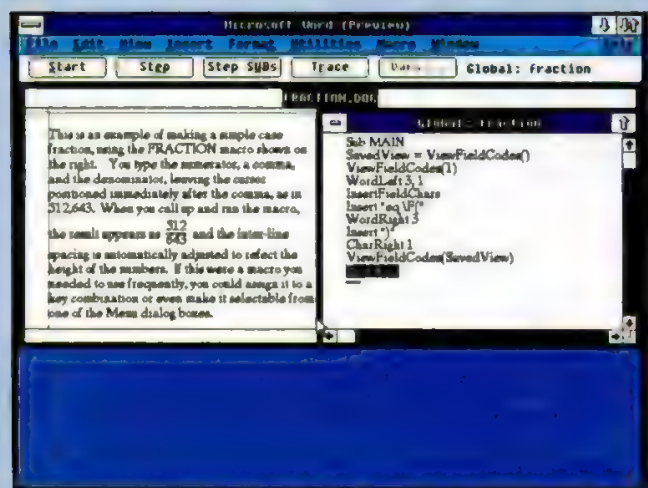


Figure 2: The macro to create a fraction in *Word for Windows*'s powerful macro programming language is shown on the right, and instructions for its use are on the left.

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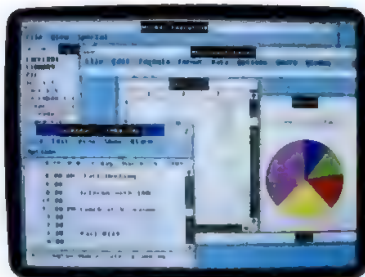
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Languages

SMALLER TURBO PASCAL PROGRAMS

I discovered a simple way to reduce the size of compiled Turbo Pascal programs. Put these three procedures at the beginning of your program (or in some unit):

```
PROCEDURE skip;
BEGIN writeln; END;

PROCEDURE wtln(XXX : string);
BEGIN writeln(XXX); END;

PROCEDURE wt(XXX : string);
BEGIN write(XXX); END;
```

Then make these replacements in your program: replace `Writeln` with `skip`; replace `Writeln(S);` with `wtln(S);`; and replace `Write(S);` with `wt(S);`, where `S` is a string expression. Make the replacements only with plain-vanilla write statements, not with fancier ones involving nonstring output, multiple arguments, or field specifiers. If you're not sure, try the substitution and see if it works. If the compiler complains, go back to the longer forms.

Your program will typically compile to a smaller .EXE file. The reduction on four of my programs ranged from 6 to 11 percent. I used TP 5.5, but I imagine the results would be similar for earlier versions.

The new programs (including screen writing) ran exactly the same as the old ones. To compare speed, I tried a loop that repeated `Writeln('Hello world!')` 1,000 times and then one that repeated `wtln('Hello world!')` 1,000 times. The two took exactly the same time to run.

Presumably, plain-vanilla write statements contain unneeded code that the new forms cut out. I'm surprised that Borland hasn't optimized its compiler to provide the most efficient code for different sorts of write statements. I bet it would be easy for it to do this—and that an optimization would give even tighter code than my crude methods have achieved.

Harry Gensler
Chicago, Illinois

■ **SMALLER TURBO PASCAL PROGRAMS:**
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The `Write` and `Writeln` statements are different from almost any other Pascal procedure. They accept a variable number of arguments, and variable TYPEs of arguments. In order to let them do this, the compiler has to treat them in a special way. Figure 1 shows six lines of Turbo Pascal code disassembled with the Turbo Debugger. As you can see, `Write` and `Writeln` generate a lot more code than the simple procedure call to `wt` or `wtln`. You save 20 bytes each time you write a string with one of the new procedures.

There is actually a speed penalty for calling `Writeln` indirectly via `wtln`. But it's minuscule when compared with the time required for scrolling the screen. Even when your program uses the CRT Unit and writes directly to video RAM, it still scrolls the screen with a BIOS call. If you test 1,000 repetitions of `Write('M'X');`; with 1,000 repetitions of `wt('M'X');`, you'll find that the latter takes about 15 percent longer. The `^M` is a carriage return code—it causes the routines to write the `X` character over and over on the same line without any scrolling.

QuickPascal users benefit from these routines exactly the same way. In fact, I disassembled the same six statements compiled under QuickPascal, and the result was the same as the listing in Figure 1. Of course the addresses were different, but every opcode was identical.—Neil J. Rubenking

USING 43- AND 50-LINE EGA AND VGA MODES

Despite support for 8 by 8 fonts in its video library and the use of 43- and 50-line text modes in its own editor, Turbo C 2.0 does not have a documented means of using these modes in your own programs. Using

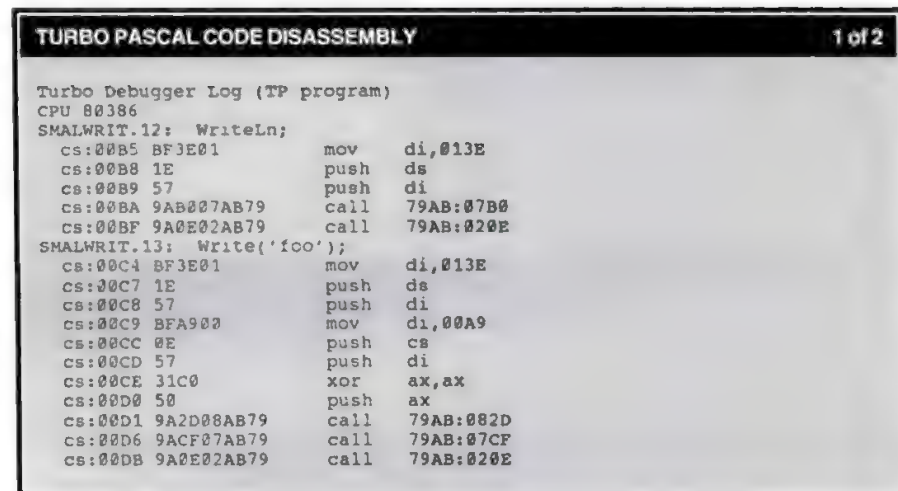


Figure 1: Here are six lines of Pascal code, each followed by a disassembly of the code it generated—obviously `Write` and `Writeln` generate a lot of code.

Languages

TURBO PASCAL CODE DISASSEMBLY

2 of 2

```

SMALWRIT.14: WriteLn('foo');
cs:00E0 BF3E01 mov     di,013E
cs:00E3 1E      push    ds
cs:00E4 57      push    di
cs:00E5 BFA900 mov     di,00A9
cs:00E8 0E      push    cs
cs:00E9 57      push    di
cs:00EA 31C0 xor     ax,ax
cs:00EC 50      push    ax
cs:00ED 9A2D08AB79 call   79AB:082D
cs:00F2 9AB007AB79 call   79AB:07B0
cs:00F7 9A0E02AB79 call   79AB:020E
SMALWRIT.15: Skip;
cs:00FC E801FF call   SMALWRIT.SKIP
SMALWRIT.16: Wt('foo');
cs:00FF BFA900 mov     di,00A9
cs:0102 0E      push    cs
cs:0103 57      push    di
cs:0104 E85CF7 call   SMALWRIT.WT
SMALWRIT.17: Wtln('foo');
cs:0107 BFA900 mov     di,00A9
cs:010A 0E      push    cs
cs:010B 57      push    di
cs:010C E80EFF call   SMALWRIT.WTLN

```

the Turbo Debugger, however, I found a system variable that contains the current screen height in lines. This byte-size variable is located 8 bytes below the address of the global variable, `directvideo`, in all memory models.

I wrote the `setfont8x8()` function to change the variable and the number of screen lines. I successfully tested it on EGA adapters, and it appears to work with all standard Turbo C text functions, including `window()` and `clrscr()`. The `setfont8x8()`

function is similar to Turbo C's `textmode()` function. However, `setfont8x8()` will select the maximum number of lines available (25, 43, or 50, depending on the adapter) and return the number of lines selected.

To return to 25-line mode, I wrote another function, `setstdfont()`, that resets the variable and the video mode to 25 lines. DEMO.C, listed in Figure 2, demonstrates the use of both functions in a program.

Note that `setfont8x8()` does not support the HGC+ and Hercules InColor cards' ex-

tended-screen modes, although you could add this capability to it. You can also modify it to take advantage of adapters that support greater than 80 columns, since this value is stored 7 bytes below `directvideo`.

Peter Arvin
Bloomington, Illinois



This was certainly a handy bit of investigative work. The DEMO program makes liberal use of Turbo C's text-mode functions to create a couple of borderless windows and display text in 43 or 50 lines. It also displays 43- and 50-line text in 40-column mode. It tested out successfully on several VGA adapters, including the IBM's unit for PS/2s and the Zenith unit.

The real work of the program is done in the `setfont8x8` function. It takes advantage of several video BIOS functions, of which the most important here is function 1Ah, which retrieves the video display combination. If this function is supported (as it is by VGA and MCGA adapters) the AL register will contain 1Ah when it returns, and the display combination will be in the BL register. Then, with the help of a table (encapsulated in the switch statement), you can determine the maximum number of lines to set.

Once `setfont8x8` determines that the number of lines on the display is greater than 25, it uses video BIOS function 11h to change the size of the character font. These

DEMO.C

```

/* DEMO.C
 * Demo for setfont8x8() and setstdfont()
 */

#include <conio.h>
#include <dos.h>
#include <stdlib.h>

#define VIDEO_BIOS 0x10

int setfont8x8(int mode);
void setstdfont(int mode);
void main(void);

void main(void)
{
    int lines, i;

    lines = setfont8x8(C80); /* Set 43/50 lines mode */

    textattr(WHITE); /* set screen colors */
    clrscr(); /* clear screen */

    if (lines < 43) /* if not EGA or VGA */
    {
        textattr(LIGHTRED);
        cprintf("No EGA or VGA present\r\n");
        exit(1);
    }

    window(20,15,70,35); /* create screen window */
    textattr((RED<<4) + WHITE); /* white on red */
    clrscr(); /* clear the window */
    for (i = 15; i <= 35; i++) /* print in the window */
        cprintf("\r\n Line %d", i);

    window(45,5,77,lines); /* create another window */
    textattr((MAGENTA<<4) + YELLOW); /* yellow on magenta */
    clrscr(); /* clear the window */
    for (i = 5; i <= lines; i++) /* print in the window */
        cprintf("\r\n Line %d", i);
    }

```

```

getch(); /* wait for keypress */

window(1,1,80,lines); /* Window whole screen */
textattr(LIGHTGRAY<<4); /* set lightgray color */
clrscr(); /* clear screen */
cprintf("\r\n Whole screen 80x%d display\r\n", lines);
getch();

lines = setfont8x8(C40); /* Set 40 col 43/50 lines */
textattr((BLUE<<4) + LIGHTGREEN); /* set blue on green */
clrscr(); /* clear screen */
cprintf("\r\n There is also a 40x%d mode\r\n", lines);
getch(); /* wait for keypress */

setstdfont(C80); /* return to standard font */
clrscr(); /* clear screen */
cprintf("\r\n Just called setstdfont()... back in 80x25\r\n");
getch(); /* wait for keypress */

exit(0);
}

/* Uses the EGA/VGA 8x8 font to display 43/50 lines text display.
 * In this case, MCGA behaves like a VGA.
 */
int setfont8x8(int mode)
{
    int maxlines, maxcol;
    char vtype, displaytype;

    textmode(mode); /* Set text mode */

    AH = 0x0F; /* get video status */
    geninterrupt(VIDEO_BIOS); /* call video BIOS */
    maxcol = AH; /* save # of columns */

    AH = 0x10; /* get video display */
    geninterrupt(VIDEO_BIOS); /* call video BIOS */
    displaytype = AL; /* save active display */
    vtype = BL;

    if (displaytype == 0x1A) /* if supported, VGA/MCGA */
    {

```

Figure 2: The source code listing for DEMO.C. This program demonstrates the ability to use 43- and 50-line text mode in Turbo C programs. The `setfont8x8()` function will select the maximum number of screen lines available, depending on the adapter.

```

switch(vtype)
{
    case 4:
        /* EGA color */
        case 5:
            /* EGA monochrome */
            maxlines = 43;
            break;

    case 7:
        /* VGA analog mono */
    case 8:
        /* VGA analog color */
    case 11:
        /* MCGA analog mono */
    case 12:
        /* MCGA analog color */
        maxlines = 56;
        break;

    default:
        maxlines = 25;
        break;
}

/* else look for EGA */
else
{
    _AL = 0x12;
    /* get video configuration */
    _BL = 0x10;
    Geninterrupt(VIDEO_BIOS);
    /* call video BIOS */

    if (_BL == 0x10)
        /* EGA not supported */
        maxlines = 25;
    else
        /* No EGA BIOS present */
        maxlines = 43;
}

if(maxlines > 25)
    /* if 43 or 56 lines */

    _AX = 0x112;
    _BL = 0;
    Geninterrupt(VIDEO_BIOS);
    /* call video BIOS */

    _AX = 0x103;
    _BL = 0;
    Geninterrupt(VIDEO_BIOS);
    /* call video BIOS */

    *((char *)directvideo - 8) = maxlines; /* set max no of lines */
    window(1,1,maxcol,maxlines); /* create logical window */
    return(maxlines); /* return new # of lines */
}

/* Reset 80x25 mode by forcing a call to BIOS change mode */
void setfont(int mode)
{
    if (mode != LASTMODE)
    {
        _AL = mode;
        _AX = 0x2f;
        Geninterrupt(VIDEO_BIOS);
        /* call video BIOS */
        mode = _AL;
    }

    _AX = 0;
    Geninterrupt(VIDEO_BIOS);
    /* call video BIOS */

    *((char *)directvideo - 8) = 25; /* Reset max lines */
    textmode(mode); /* Update Turbo C's variables */
}

```

functions are fully documented in Richard Wilton's excellent book, *Programmer's Guide to PC and PS/2 Video Systems*, from Microsoft Press.

While the program makes liberal use of Turbo C's pseudoregisters, keep in mind that they correspond directly to the CPU registers. Because of compiler optimiza-

tion techniques, a CPU register like AX may not contain the same value only a line or two later in the code. So I added the displaytype variable in the setfont8x8 function in order to store the value of _AL after the return from a BIOS call and to ensure that the value in that register will be preserved.—Richard Hale Shaw

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CIRCLE NO. 284 ON READER SERVICE CARD

by
Jeff Proise

Tutor

DOS 4.0'S SHARE COMMAND

What does DOS 4.0's SHARE.EXE program do? Why must it be loaded from the CONFIG.SYS file with the command INSTALL=SHARE.EXE? And why, if you fail to load it, are you prompted with the message "Warning: SHARE should be loaded for large media"?

Gregory A. Pearce
Arlington, Virginia



In DOS 4.0, SHARE.EXE serves a dual role: it controls access to shared files on network hard disks, and it allows you to access drive partitions that are larger than 32MB. The error message you describe means simply that you have a large partition and that DOS is trying to load SHARE.EXE but can't find it on the hard disk. By default, DOS 4.0 searches the directory pointed to by the SHELL= command in CONFIG.SYS and, failing that, tries again in the root directory. If SHARE.EXE isn't in either location, and if you haven't spelled out the proper path to it with an INSTALL= command, then DOS warns you that you won't be able to access your large partition without it.

CLEANING UP AFTER CLS

In your September 12, 1989, column, you printed a short program that switches an EGA from 25-line display mode to 43. I like the program, but DOS's CLS command still clears away only the top 25 lines of text. How can I clear the bottom half of the screen in 43-line mode?

Sharon Hod
Rishon-Letzion, Israel



When Charles Petzold published the original EGA43.COM in *PC Magazine's* September 16, 1986, Programming/Utilities column, he also published a short program called CS.COM to go along with it. CS clears the screen just like CLS on EGAs but works no matter how many rows of text are displayed. Figure 1 shows the DEBUG listing for

- **DOS 4.0's SHARE COMMAND:** DOS needs SHARE.EXE loaded in order to access network drives or partitions greater than 32MB.
- **CLEANING UP AFTER CLS:** DOS's CLS command doesn't always go as far as it should. Here are two alternatives.
- **A CURIOUS MESSAGE FROM CHKDSK:** If CHKDSK doesn't recognize your disk, you'd better back up and reformat your drive now.
- **MORE CHKDSK CHAOS:** Why does CHKDSK report more hidden files than actually exist?
- **FLOPPY DISK WOES:** When does DOS provide the same directory data for different floppies?

CS.COM exactly as it appeared more than three years ago.

One drawback to using CS is that it is relatively slow—DOS has to find it on-disk and load it every time you type the command. By contrast, CLS is an internal command that executes almost instantaneously. A more elegant solution is a program that works in the background to provide a simple fix for the way CLS handles the screen. Michael J. Mefford's ANSI.COM, which appeared in the Utilities column of January 31, 1989, is one such program. It takes over the job of clearing the screen from CLS and substitutes its own screen-clearing logic. With ANSI.COM installed, typing CLS will clear the entire

screen, no matter how many rows of text are displayed.

ANSI.COM is the functional equivalent of DOS's extended screen- and keyboard-control device driver, ANSI.SYS, but it comes without ANSI.SYS's built-in deficiencies. It will work with any display density (unlike ANSI.SYS, which is hardwired for 25-line screens), and it lets you set screen colors the way you want them and assign command strings to function keys, to boot. If you don't already have a copy, you can download ANSI.COM from the Utilities library in PC MagNet's Utilforum.

CS.SCR	COMPLETE LISTING
	
N CS.COM	
A 100	
MOV DL,18	
SUB BH,BH	
MOV AX,1130	
INT 12	
MOV AH,0F	
INT 12	
DEC AH	
MOV CH,DL	
MOV CL,AH	
MOV AH,00	
CMP AL,07	
JZ 011D	
CMP AL,03	
JA 012D	
MOV DL,20	
MOV AH,02	
INT 21	
MOV AL,08	
MOV AH,0E	
INT 12	
MOV AH,08	
INT 10	
PUSH BX	
MOV BH,AH	
MOV DX,CX	
SUB CX,CX	
MOV AX,0600	
INT 10	
POP BX	
SUB DX,DX	
MOV AH,02	
INT 10	
INT 20	
R CX	
42	
W	
Q	

Figure 1: This DEBUG script creates CS.COM. The program works just like DOS's CLS command on EGA screens, but it will clear any number of rows of text displayed.

Tutor

A CURIOUS MESSAGE FROM CHKDSK

I've been receiving a curious message from CHKDSK. It tells me that my hard disk is a "Probable non-DOS disk," then asks me if I want to continue. When I answer yes, it analyzes the disk and reports no errors. The message is making me extremely nervous. What's wrong?

Steven Lazan

Lake Hiawatha, New Jersey

 One of two things: either you didn't format the partition in question after running FDISK to set it up, or a wayward program has corrupted the media descriptor byte in the partition's file allocation table (FAT), preventing CHKDSK from positively identifying it as a DOS partition.

When CHKDSK goes to work on a hard disk partition, it checks the media descriptor byte at offset 00h in the sector that holds the first 512 bytes of the file allocation table (the second logical sector in the partition) to determine what type of disk it's dealing with. Figure 2 lists the media descriptor values that CHKDSK recognizes and what each one means. On a hard disk, it should find the value F8h, placed there by the FORMAT command when the partition was initially formatted. If you neglected to format the partition, the descriptor value will not be there for CHKDSK to find. If it doesn't find a valid descriptor value, CHKDSK will report a probable non-DOS disk.

The descriptor byte itself might be in-

valid for either of two reasons. An application program may have inadvertently written data to the wrong sector and destroyed the descriptor byte. This is especially likely to happen if you develop and debug programs that access disks at the interrupt 13h or 26h level.

And it's sometimes possible to FDISK a drive and actually write data to a partition without formatting it first. Why? Normally FORMAT sets up the FAT, writing non-zero values to the first few bytes, zeroing the rest, and storing a duplicate copy of the FAT at another location on the disk in case the first one is destroyed. But if the bytes in an unformatted partition already happen to be zeroed, the only way DOS can tell that there is no valid FAT there is by checking the media descriptor byte or verifying that the two or three bytes that follow the descriptor byte (two in 12-bit FATs, three in 16-bit FATs) are set to FFh. Unfortunately, DOS performs neither of these checks. As a result, DOS can be fooled into copying data to a partition that hasn't been initialized.

So what should you do? You might be tempted to use DEBUG to poke a valid descriptor byte into the FAT. That would certainly keep CHKDSK from responding that the disk is a non-DOS disk. But if you haven't formatted the partition, you're missing another key element of the file system as well: the boot sector, which contains the BIOS Parameter Block (BPB). DOS uses the BPB to obtain information about how the partition is laid out. In the other case—if the partition was formatted and the media descriptor byte was corrupted after the fact—there's really no guarantee that other elements of the file structure weren't damaged as well. In any case, the safest solution is to back up the drive and reformat the offending partition. The only sure bet is that if you don't and things do go awry, it will happen at the worst possible time.

MORE CHKDSK CHAOS

Why is it that when I run CHKDSK on my hard disk, it reports finding three hidden files? I know for a fact that there are only two, IO.SYS and MSDOS.SYS, placed there when I formatted the disk. Odder still, the phantom file is 0 bytes in length. I know that because the total number of bytes that CHKDSK reports in hidden files corresponds exactly to the combined length of the two system files. What gives?

R. H. Sekaly

Halifax, Nova Scotia



The extra file holds your hard disk's volume label. To store a volume label, DOS creates a new entry in the root directory and writes the text of the volume label to the slot in the directory entry where filenames are stored.

It's sometimes possible to FDISK a drive and actually write data to a partition without formatting the partition first.

That's why volume labels are limited to 11 characters—DOS reserves only 11 bytes for filenames.

DOS also sets bit 3 of the entry's attribute byte to identify it as a volume label and bit 1 to mark it as hidden, so that it doesn't show up when you list the files in the root directory. The "file length"—a figurative term because the volume label really has nothing to do with a file—is 0 bytes because there are no data clusters associated with it.

FLOPPY DISK WOES

What could cause a 1.2MB floppy disk drive on an AT to not recognize any disk placed inside it after the first? If I boot the AT, place a disk in the drive, and type DIR, I get the directory of the disk currently in the drive. If I remove it and insert another, I get the directory of the first disk. The only way I can get the unit to recognize the new disk is by pressing Ctrl-C.

I tried replacing the drive with 1.2MB models from different manufacturers, but with no luck. I also tried a 360K drive in its place and it seemed to work fine. Any ideas?

Jon Spencer

New York, New York



Sounds as if you have a floppy disk change line gone bad. The change line—a standard feature on all 1.2MB drives but one never implemented on 360K models—is used by DOS to determine when the door of a high-density drive has been opened. If the change line



THE MEDIA DESCRIPTOR BYTE	
VALUE	DESCRIPTION
F8h	Hard disk
F9h	1.44MB 3.5-inch, 720K 3.5-inch, or 1.2MB 5.25-inch floppy disk
FCh	180K 5.25-inch floppy disk
FDh	360K 5.25-inch floppy disk
FEh	160K 5.25-inch floppy disk
FFh	320K 5.25-inch floppy disk

Figure 2: The media descriptor byte at offset 00h in the file allocation table identifies the type of hard or floppy disk. The values FCh, FEh, and FFh are holdovers from the early days when 360K floppy disks had yet to arrive on the scene.

Tutor

(pin 34 on the floppy disk drive controller interface) indicates that the door hasn't been opened since the last disk access, DOS assumes that the same disk must still be in the drive and doesn't go to the trouble of reading it if the information you want is cached in the disk buffers. If the drive door *has* been opened since the last disk access, DOS calls interrupt 21h, function 0Dh, to flush the disk buffers, then reads the disk.

As you've already discovered, Ctrl-C neatly circumvents the change-line problem by forcing a physical disk access. The reason: when you press Ctrl-C, DOS flushes its disk buffers—just as if a drive door had been opened and closed.

There are several reasons why the change line may not be functioning properly. Some 1.2MB drives have jumpers that allow the change line to be selectively enabled and disabled. If the line has been disabled, DOS isn't smart enough to know the difference; once it determines that the capacity of the drive is 1.2MB, it *assumes* that it has a working floppy disk change line. Since you've replaced the drive with another manufacturer's model of the same capacity and received the same erroneous results, however, it seems unlikely that jumper settings are the problem.

A more likely possibility is that the cable connecting the drive to the controller is bad or that the floppy disk drive controller itself is malfunctioning. For starters, unplug and replug the cable to ensure that it is properly connected (this would be a likely possibility if the problem were an intermittent one); next, try replacing the cable and see if that corrects the problem. If it doesn't, have the controller checked out by a qualified technician, or, if you have access to a spare, try swapping out the old controller for a new one.

ASK THE TUTOR

The Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, as well as answering basic questions about DOS and systems in general. To have your questions answered here, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). We're sorry, but we cannot answer questions personally. ■

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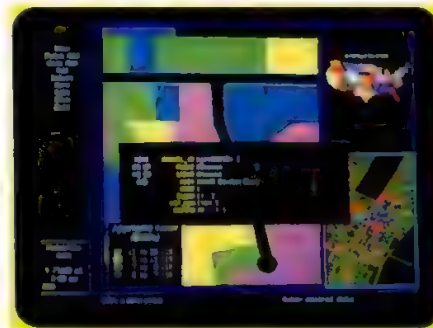


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CIRCLE 367 ON READER SERVICE CARD

by
Frank J. Derfler, Jr.

Connectivity

WHAT'S IN A NAME?

I know what a LAN is, and I think I understand WANs, but lately I've been hearing about MANs. What is a MAN?

John Leffer
Pittsburgh, Pennsylvania



"What is a MAN?" No, this isn't the opening line of a soliloquy. The acronym *MAN* stands for *metropolitan area network*. The working definitions of *LAN*, *MAN*, and *WAN* often depend on the installation's configuration, but there are a couple of good rules of thumb for sorting them out.

Metropolitan area networks make up a legitimate subcategory of networks. The Institute of Electrical and Electronics Engineers (IEEE) describes standards for the operation of networks. They have a special committee, the IEEE 802.6 Working Group, that develops MAN standards. Other IEEE committees in the 802 series developed standards for LANs, while international standards often guide wide area network (WAN) design. So MANs, WANs, and LANs are all separate entities, according to the IEEE.

A local area network typically is a privately owned internal communications system designed to link nodes within a building or group of buildings. LANs span a distance of less than 2 miles and don't cross property boundaries. The "privately owned" criteria and distance limitations are important. They make it clear that LANs aren't subject to tariff regulation by state or federal authorities.

Technically, LANs operate at speeds between 2 and 16 megabits per second and allow users to share files, printers, and other resources as if each resource were on the desktop.

Metropolitan area networks can take many forms, but the term is often associated with a backbone network of fiber-optic cables such as the one strung by private enterprises in the old coal delivery tunnels under Chicago. A MAN could span a hundred miles. Local exchange carriers (the

■ **WHAT'S IN A NAME?**
Networks are distinguished by the distances they span.

■ **FRAMING AND PARITY ERRORS:** Transmission errors cost more than you think.

■ **USING FIBER OPTICS IN PC LANS:** The virtue of fiber-optic networks today is reliability, not speed.

local telephone companies) provide a great deal of the MAN connectivity, as do a growing number of cable television companies. While some organizations install their own microwave systems for MAN circuits, the majority lease circuits from local carriers. State utility commissions may regulate the tariffs for MAN services.

MAN carriers usually offer services in 1.544-megabit-per-second increments and their backbone services provide throughput in the range of 80 megabits per second. Even a single 1.544-megabit-per-second channel can provide LAN-like response times for most tasks. The draft 802.6 MAN standard calls for a Distributed Queue Dual Bus topology with drops at each service location.

Wide area networks (WANs) generally link cities. Specialized long-distance carriers lease circuits to organizations and communications companies to construct WANs. You can buy service at any speed, but speeds of 56 and 64 kilobits per second or less are the most economical, and 1.544-megabit per second service is common. The Federal Communications Commission has authority over the rates these long-distance carriers charge.

MAN and WAN carriers can offer

many services, in addition to providing the basic circuits. If the carrier adds packet routing and error detection using a protocol like X.25, the WAN becomes a VAN (value added network). Companies like Tymnet, Telenet, AT&T, and Computer Sciences Corp. provide X.25 VAN services over their WANs.

The dividing lines between LANs, MANs, and WANs, aren't written in stone, and some organizations have campuswide LANs covering many miles that deliver "local" performance.

FRAMING AND PARITY ERRORS

The modem management system on our local area network regularly reports framing errors and parity errors. We use some of the networked modems to exchange electronic mail between LANs and others to access mainframe computers under IBM's Synchronous Data Link Control (SDLC). What do these errors mean? Should we do anything about them?

Fred Berdick
Las Vegas, Nevada



Framing errors occur when the receiver in a modem or RS-232C interface expects a stop bit and finds a logical 0 instead. Since the receiver knows that a stop bit follows a start bit after a certain number of data bits, it anticipates the stop bit. If it doesn't receive the expected stop bit, it declares an error.

You can get framing errors in either asynchronous or synchronous transmissions, but they are more likely to occur in the asynchronous transmission you use to move e-mail between LANs.

A parity error is a little different, but the effect is the same. The receiver calculates the parity of a block of data and compares the expected value with the actual value. If the two values don't agree, the receiver latches up an error flag.

These errors don't hurt you immediately, because the file transfer protocols and SDLC detect errors and request a retransmission of data. But any errors you get re-



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USING FIBER OPTICS IN PC LANS

You've often suggested that people wire their buildings for networks with unshielded twisted pair wire, but you don't discuss fiber optics much. Isn't fiber the way of the future? Don't we need the higher speed of fiber optics for big graphics applications and to take advantage of the new, fast servers and operating systems like *NetWare 386*?

Brea Lambert
Wilmington, North Carolina



Pulling fiber-optic cable throughout a building doesn't ensure that technology won't pass you by. First, you should understand that today's fiber-optic adapters for LANs don't give you faster throughput than copper cables. Typical fiber-optic systems today shouldn't be confused with the 100-mega-bit-per-second systems promised under the Fiber Distributed Data Interface (FDDI) specification. They are very different.

Networks using fiber-optic cable gain two benefits: they don't send out or intercept RF (radio frequency) radiation and signals travel farther with less attenuation.

Reducing transmitted RF is important if you don't want anyone to tap into your network by receiving and decoding the low-level signals all networks emit. A detailed body of knowledge and standards known by the acronym TEMPEST defines techniques for reducing electronic emissions. TEMPEST is important to many organizations with big budgets—primarily in or associated with the federal government. DCA 10Net ((513) 433-2238) has a group selling TEMPEST-certified fiber-optic LANs to organizations such as the FBI. If you aren't concerned about sophisticated attempts at network intrusion, this virtue of fiber networks won't impress you.

However, the ability of fiber LANs to shrug off outside interference might turn your head. Electrical and electronic noises in many buildings, noises from elevator relays, radio transmitters, faulty electrical equipment, and many other sources can disrupt the effective throughput of networks. Networks using fiber-optic cable simply don't pick up electrical noises.

Because the noise level is lower and be-

cause the light pulses lose less power over a given length of fiber cable than electrical signals do over wire, data signals travel farther without regeneration. Signal timing considerations often limit the practical amount of distance you gain with fiber optics, but if you have a long cable run, fiber could reduce signal loss.

The logical uses for fiber-optic LAN connections today are in networks requiring very high reliability and in single runs through areas of high electrical noise. Choosing fiber isn't an either-or situation. Several companies market fiber-optic transceivers that connect to standard LAN adapter boards and allow you to replace cable with fiber on specific legs. You can buy fiber-optic adapters for ARCnet, Ethernet, and Token-Ring networks. Centralized hubs can interconnect fiber, coax, and twisted-pair cable on these networks.

Companies ranging from AT&T to Zenith market products that let you mix and match fiber and other media in networks. Codenoll ((914) 965-6300) was one of the first companies selling fiber LAN adapters for PCs. SynOptics Communications ((415) 960-1100) is the fastest growing, and Optical Data Systems ((214) 234-6400) has the broadest range of products.

The Fiber Distributed Data Interface (FDDI) specification emerging from the American National Standards Institute (ANSI) describes networks a world apart from the fiber-optic techniques commonly used in LANs today. The FDDI cable is different, the signaling is different, and the applications will be different. FDDI is high speed, long distance, and expensive. Announcements of real FDDI products have come from companies as diverse as Hewlett-Packard and SimpleNET Systems. As soon as products arrive in the LAN Labs we'll tell you what they can do, but today's Ethernet, ARCnet, and Token-Ring networks won't be replaced by FDDI as it's described today.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay \$50 for any tips we print. Please submit your letter on a disk along with a print-out. Then mail your contributions to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PC MAGAZINE LAN LABS). We're sorry, but we're unable to answer letters personally.

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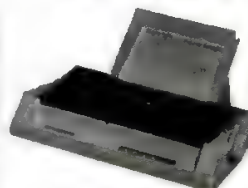
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q. ☐ Networked together

6. Does your company own

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7. Do you plan to buy any PC product?

- u. ☐ Now
v. ☐ In 4 to 6 months
w. ☐ In 6 to 12 months
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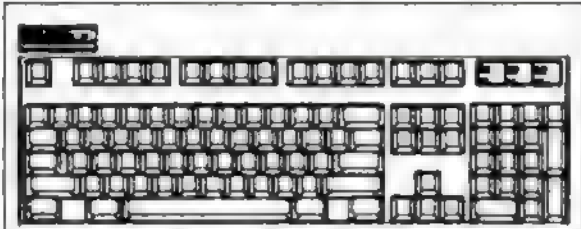


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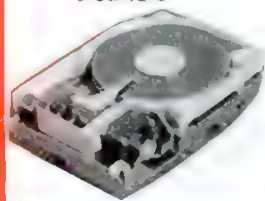
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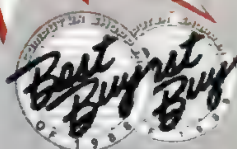
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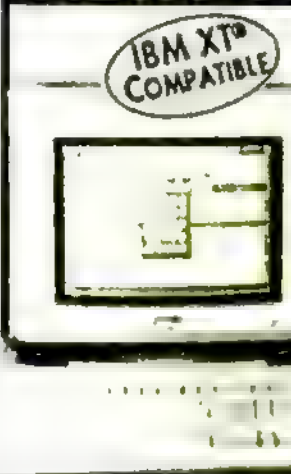
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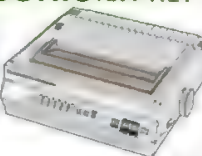
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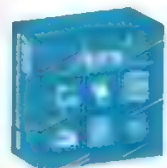
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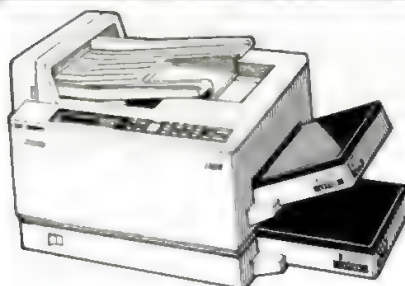
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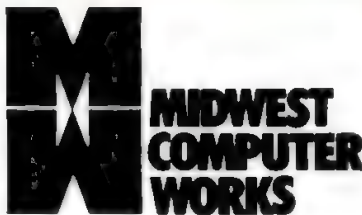
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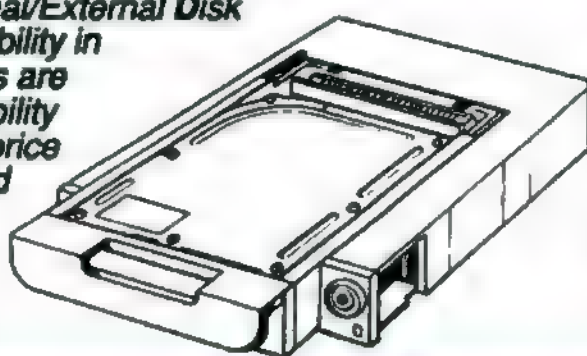
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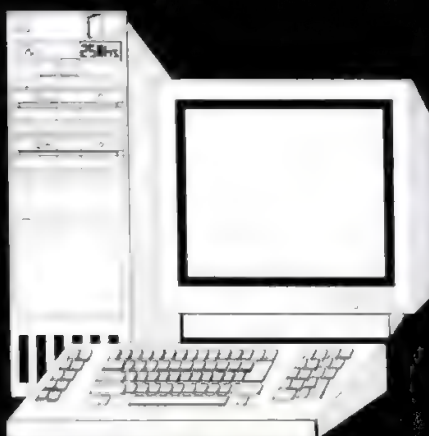
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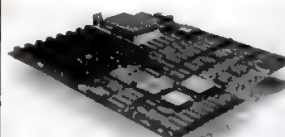
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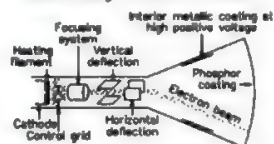
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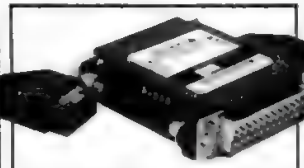
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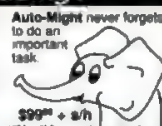
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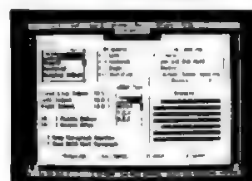
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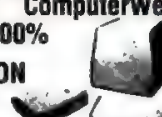
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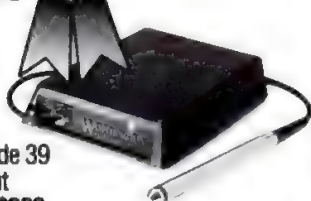


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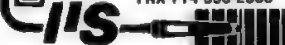
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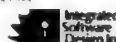
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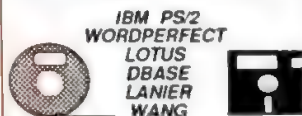
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CIRCLE 497 ON READER SERVICE CARD

After Hours

Products for the Leisure Side of Personal Computing

The New Print Shop Adds Fonts, Flexibility to A Longtime Favorite

EDUCATION
By Lulea Simons

My sister-in-law would love *The New Print Shop* from Broderbund Software. She could use this update of the classic *Print Shop* program to turn out zany party invitations and bake-sale posters at an even more frantic pace than she does now. And she could do it all with no thought to such complexities of computer graphics as installing fonts or importing art files.

Like the original *Print Shop* (which has sold almost 1.8 million copies on the PC, Apple, and Commodore platforms), *The New Print Shop* gives users an easy route to self-expression. It comes complete with 12 internal fonts and more than 50 new pieces of clip art. The various champagne bottles, sports gear, Hanukkah candles, file folders—even the computer equipment—symbolize a typically American lifestyle.

EASY-TO-USE MENUS

It doesn't matter whether you choose one of the predesigned greeting cards, signs, posters, letterheads, banners, or calendars included with the \$59.95 program, or opt to create your own design. Either way, the self-explanatory menus and default layouts make it almost impossible to create an ugly design. The software's manual is almost totally unnecessary.

Previews of work in progress are available at every conceivable opportunity in *The New Print Shop*. At various points within the software, you can view a WYSIWYG image of your creation in a split-screen

preview, or by tapping the F10 key, or by hitting the Alt-F10 key combination. Pop-up windows give you a preliminary look at artwork before you incorporate it into your document. The variety of preview methods is a response to memory limitations, and though they sound confusing, you'll find yourself responding to the various prompts naturally.

The real power in *The New Print Shop* resides in the new Customization module. Now your personal aesthetic sense can override the program's default designs. The result is considerable flexibility. You can

place multiple graphics on a page or move, flip, resize, and color the clip art. You can even convert text into a graphic and manipulate it like any other piece of art. You may find, however, that the five special type effects (including outline and shadow) give you more than enough design options for text.

Some of the enhancements are relatively modest. The upgrade lets you print T-shirt iron-ons, and you can now automatically personalize cards with your name. A graphics editor permits modification of clip art. These aren't power tools—and yet they make *The New Print Shop* more effective and fun.

Ambitious designers can supplement *The New Print Shop* with three optional graphics libraries available for \$34.95 each. The Sampler, Party, and School and Business Edition li-

EDUCATION
Fisher Price offers educational software

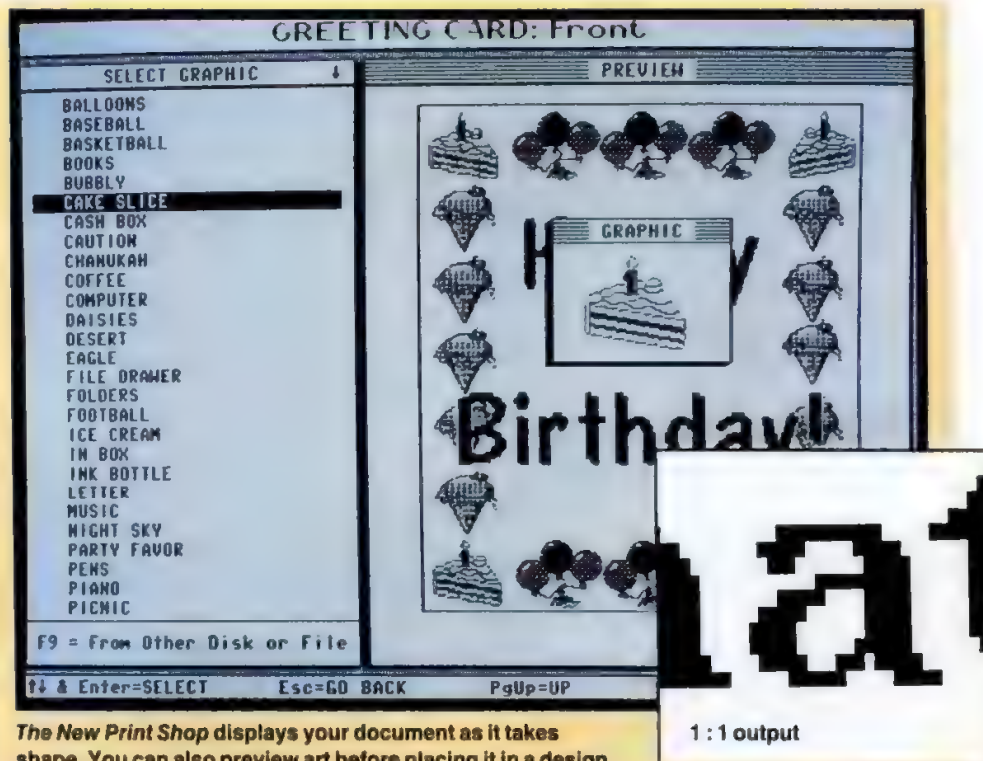
GAMES
Populous lets you play God

The Caveman Ugh-lympics: pre-historic sports, with tongue in cheek.

braries all contain over 100 additional pieces of clip art.

Educators who found the original *Print Shop* a perfect program for the classroom will welcome the \$69.95 School Edition of *The New Print Shop*.

CONTINUES



The New Print Shop displays your document as it takes shape. You can also preview art before placing it in a design.

After Hours

The New Print Shop

CONTINUED

which has a Teacher's Guide and lesson plans.

No software is perfect, and *The New Print Shop* still has some shortcomings. It implements color poorly. The color preview, for example, is available only in EGA mode and doesn't work at all for banners. Moreover, color choices within the program are restricted to the six solid hues of red, blue, yellow, green, orange, and purple: no gray shades or color tints are allowed. Worse, instead of automatically converting color clip art to black-and-white at print time, *The New Print Shop* requires you to use an ancillary conversion utility.

Unlike Broderbund's newer products, such as *BannerMania*, that take advantage of vector font technology, *The New Print Shop* is totally bitmapped. Though the artwork is supplied in three sizes (small, medium, and large), art and type are restricted to the resolution of a 9-pin dot matrix printer. When you enlarge or otherwise modify images, you'll encounter serious jaggies in your output.

But when a 9-foot banner proclaiming the Knicks as 1990 champs (jaggies and all) produced whoops of glee from the biggest basketball fan I know, I

realized that high-resolution art is not always the point. *The New Print Shop* proves that simple messages and heartfelt sentiments can be easy to express with a PC.

List Price: *The New Print Shop*, \$59.95, upgrade \$20. **Requires:** 512K RAM (640K and a hard disk for color printing), graphics adapter, DOS 2.1 or later. Broderbund Software Inc., 17 Paul Dr., San Rafael, CA 94903-2101. General information: (800) 521-6263. Print Shop hotline: (800) 999-3256.

CIRCLE 412 ON READER SERVICE CARD

Fisher Price, The Toy Company, Debuts Software For Computer Tots

EDUCATION
by Don Trivette

Fisher-Price, one of the best-known names in toys, now offers a line of software designed to educate and entertain the three- to eight-year-olds in your life. There are seven programs in the series, including the four I recently played with a couple of preschoolers.

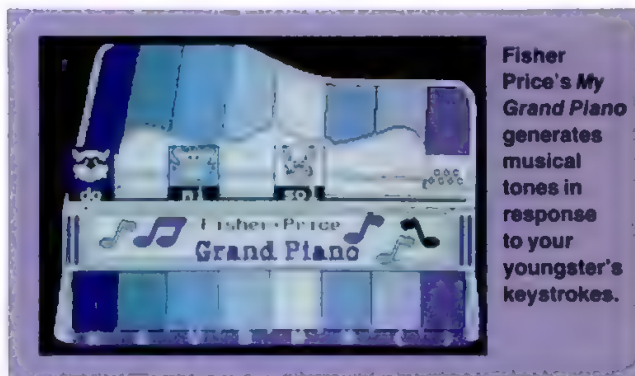
My Grand Piano was inspired by the ever-popular toy piano. Computer keys—z x c v b n m < >—simulate piano keys, each producing a distinctive note through the PC's tiny speaker. One option plays any of 30 familiar tunes including "Mary Had a Little Lamb" and a lively "Jingle Bells," while another option teaches kids how

to play a selected tune by highlighting the proper keys on the screen. *My Grand Piano* also has record and playback modes so that a budding Beethoven can compose his own songs.

Little People Bowling Alley is an arcade-style game that can be played by two children at two levels of difficulty. The begin-

key before proceeding to the blaze. The toughest level allows just 50 seconds to reach the house. Once the firefighter is on the scene, he or she has to maneuver the ladder truck until it is under a window to rescue the people inside.

It's hard to fault educational games that have a price tag of



Fisher Price's *My Grand Piano* generates musical tones in response to your youngster's keystrokes.

ner's ball always goes straight down the alley, while the advanced player can throw curve balls. To add educational value, this six-pin bowling alley has an option that lets kids compute and record their own scores. If an incorrect score is entered, the computer beeps and makes the correction.

I Can Remember is a kid's version of the old TV show Concentration. The child picks a box, looks at the picture behind it, and matches it with an identical box somewhere else on the board. A kid can play alone, with a friend, or against the computer. When all the boxes are turned over, the board reveals—guess?—a Fisher-Price

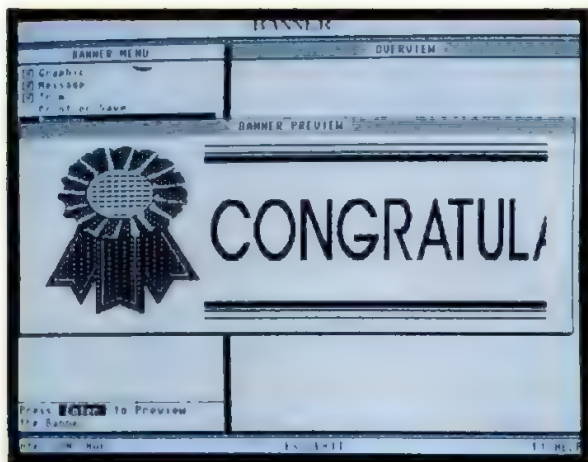
toy. The most difficult level has 12 boxes (six matches), and the easiest level, six boxes (three matches). *Firehouse Rescue* is a maze game. Your child guides a fire truck around the streets of a city until it reaches the house that's on fire. Advanced levels of play spread the city over several screens and require the truck to pick up a flashing

less than \$15. Nevertheless, there are some things Fisher-Price could, and should, have done better. Tops on the list is the poor operating system interface: most of these games won't gracefully exit back to DOS. A spokesman acknowledged the problem and said that future versions would use the Esc key to quit the program. Until then, a cold start may be necessary to get back to the DOS prompt. On a more considerate note, the designers did designate the F1 key to turn off the sound (thank you, thank you, thank you!).

Second on my wish list would be better color and graphics. These games are designed for CGA monitors because the developer feels that there are more of those displays around than EGA or VGA. Maybe so, but it doesn't take much programming to test for monitor type and use better graphics when appropriate. Compared with the *Stickybear* series from Weekly Reader Software, the Fisher-Price graphics are dull.

Fisher-Price has pretested all of these games in its New York laboratory with real kids and real parents and claims that the games are suitable for ages three to eight. But the disks are not self-booting, so someone will have to bring up the PC, insert the disk, and type the appropriate

CONTINUES



The New Print Shop gives you greater control over many design elements such as placement of graphics.



COMING UP

■ EVERYONE'S DISPLAY: SUPER VGA

With the advent of low-cost 386-based computing, 800- by 600-dot-per-inch resolution Super VGA is emerging as the standard for desktop displays. Next time, we review 28 Super VGA monitors that'll make your graphics applications shine.

■ NEW FROM THE OLD COUNTRY: X.25

Thanks to tariff changes, Europe's popular X.25 communications protocol is gaining ground in this country. Connectivity maven Frank Derfler, Jr., and his staff rate X.25's LAN-to-LAN performance versus regular dial-up connections and tell you why it's better to switch than fight. We also review three products that support the X.25 protocol.

■ ENDURANCE TESTS

Our reviewers give you the inside scoop on what has stood the test of time—and what hasn't—in an eclectic group of image creation and manipulation products. The latest installment of our Endurance Tests series looks at presentation software, desktop publishing packages, mice, monitors, and optical character recognition systems.

■ LEARN YOUR AVC's

Contributing editor Alfred Poor takes an in-depth look at IBM's Audio Visual Connection, a multimedia package that integrates high-fidelity audio, color video, and animation. Will this be the training and education tool of the future? Our feature explores AVC and associated multimedia hardware and software.

■ TAKE YOUR ACT ON THE ROAD

PC Magazine focuses on connectivity in our latest look at the laptop revolution. Contributing editor M. David Stone and PC LAN Labs connectivity expert C. G. Milligan help you plan a strategy for fitting your mobile communications and networking solutions into tight places. ■



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After Hours

Fisher Price

CONTINUED

ate command. It will be an exceptional three- or four-year-old who can play without assistance from Mom or Dad, and even older children will require some help the first time.

Of these four titles, *Firehouse Rescue* was both my favorite and the choice of the kids in my neighborhood. *Bowling Alley* was also a hit, although there wasn't much enthusiasm for computing the scores. *Grand Piano* is the most complicated of the four because it has the greatest number of options and requires the most instruction. *I Can Remember* is a little tedious and sedate for active kids and was the least favorite among my group of energetic test subjects.

The titles we didn't play are *Fun Flyer*, *School Bus Driver*, and *Perfect Fit*. As long as you don't expect too much for your \$15 investment, you won't be disappointed.

List Price: *Little People Bowling Alley*, *My Grand Piano*, *I Can Remember*, *Firehouse Rescue*, \$14.95 each. **Requires:** 256K RAM, graphics adapter, DOS 2.2 or later. GameTek/IJE Inc., 2999 NE 191st St., North Miami Beach, FL 33180; (305) 935-3995.

CIRCLE 413 ON READER SERVICE CARD



Populous: Compete with a Diet as You Struggle To Develop Your Planet

GAMES
by Barry Brenesal

Imagine a world ruled by two gods—one human, and one computer—whose power is proportional to the numbers of their worshippers. Each deity invokes catclysms (volcanos, earthquakes, etc.) and commands armies of followers to destroy first the rival god's people, and then the rival himself. Got that? Well, *Populous* simulates such a world.

The STI (Slay The Invaders) gaming theme may be old, but its treatment here is original and interesting. The play screen is certainly unique: 3-D worlds materialize within the pages of an open book. As your cursor moves down the page, the world view scrolls up to show an ever-changing geography. The superb, varied graphics possess (believe it or not) a certain delicate charm.

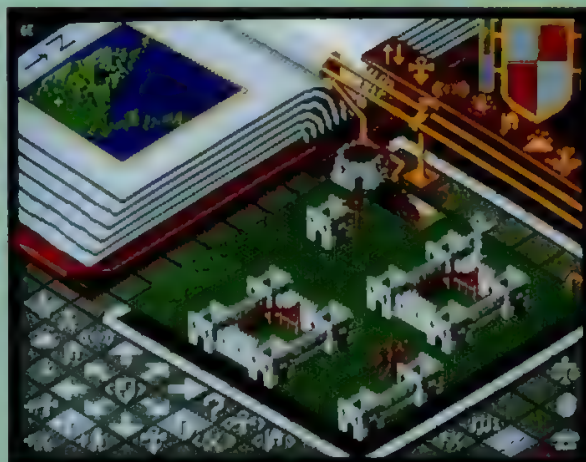
The details of terrain, rules of involvement (speed, extent of earthquake damage, etc.) and computer strength are highly user-configurable. All of your options are covered in the terse but clear documentation. The game also includes instructions for playing via modem, sup-

around stained coffee mugs and stacks of diskettes.

Populous differs from Maxis Software's *Simcity* in that you won't want to live in the worlds you control in *Populous*. Still, it's a fun place to visit.

List Price: *Populous*, \$49.95; *The Promised Lands* accessory disk, \$14.95. **Requires:** 512K RAM (384K for CGA); CGA, EGA, or VGA graphics adapter; DOS 2.1 or later. Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404; (800) 245-4525.

CIRCLE 414 ON READER SERVICE CARD



porting 300-, 1,200-, 2,400-, and 9,600-bit-per-second transmission rates.

Populous's only weakness lies in the way it limits your choice of weapons: keyboard or mouse. The latter makes more sense since the game's command set is extensive and the representative icons make memorizing a lot easier. On the keyboard, Shift-F3 simply doesn't remind you of "Gather then Settle" no matter how long you look at it. And in a game executed in real time, a moment's hesitation can mean the difference between victory and a new god on the block.

An accessory disk, *Populous: The Promised Lands*, gives you five more landscapes to invade and destroy, all with a surreal and/or humorous twist. One landscape features aristocrats and peasants duking it out 'neath the Arc de Triomphe. Another scenario presents a land of perforated computer paper, where your armies march

A Stone Age Rage: The Olympics, As Cavemen Might Have Competed

GAMES
by Don Trivette

Imagine Fred Flintstone and Barney Rubble in the Olympics and you have a good idea of what Electronic Art's *The Caveman Ugh-lympics* looks like. Computer store shelves sag under the weight of sports simulations—baseball, football, and basketball to name a few—and most of them are pretty difficult to tell apart. *Ugh-lympics* is truly original, however, and it deserves a closer look.

There aren't any troglodyte athletes left to promote this whimsical poke at the Olympic games, but its sheer originality more than makes up for the lack of a celebrity endorsement.

CONTINUES

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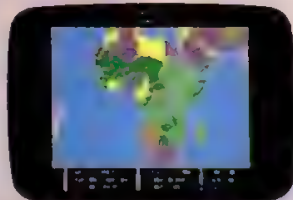
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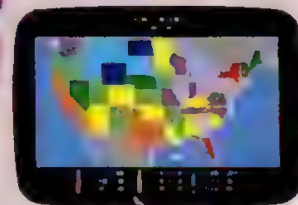
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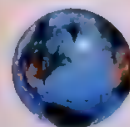
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After Hours

Ugh-lympics

CONTINUED

You and up to six of your hairy-footed friends compete in events that are as extinct as the Mesozoic era. But first you must pick a character to represent your athletic prowess. Possibilities range from Glunk, a master of the ancient art of Club-Fu, to Crudla, who practices at home by clubbing her husband. (Hint: Gronk obviously eats Wheaties, but Vincent couldn't spread warm butter.)

Once you select an identity, the games begin. First comes the Mate Toss, an Ugh-lympic event designed to show your affection for the opposite sex. Grab your mate by the hair and swing her (or him) in a circle. Then let go. The faster you swing, the further he or she travels before finally bouncing down. If you want to see a really ecstatic mate, toss him or her at least 70 feet.

The Saber Race is a straightforward foot race against a sabertooth tiger. Unfortunately, sportsmanship among the Neanderthals is unknown. If your fellow competitor overtakes you, he'll grab your loincloth and toss you to the big kitty. If you get eaten, you lose.

The third event is Fire Making, my personal favorite. No Zippos allowed: you must rub two sticks together until you get the tiniest whiff of smoke, and then blow like Hurricane Hugo. (Hint: if your opponent is getting ahead of you, whack him

on the head.) The next event is Clubbing. Nothing special here: this looks just like pro wrestling on TV.

The Dinosaur Race and Dinosaur Vault are the last two events. In the race you guide your reptilian steed through an obstacle course—not an easy task for a critter with a brain the size of a pea. In the dino vault . . . well, guess what happens if you come up short? (Don't let anyone tell you that dinosaurs were vegetarians.) Points are awarded for each event, and the winner gets to re-

cord his name in the caves of fame.

Caveman Ugh-lympics is one of the wittiest games to come along in some time. The expressions on the faces of the prehistoric contenders will leave you rolling on the floor, and there's a surprise at every turn. If you swing your mate too long, for example, you'll turn red in the face and throw up.

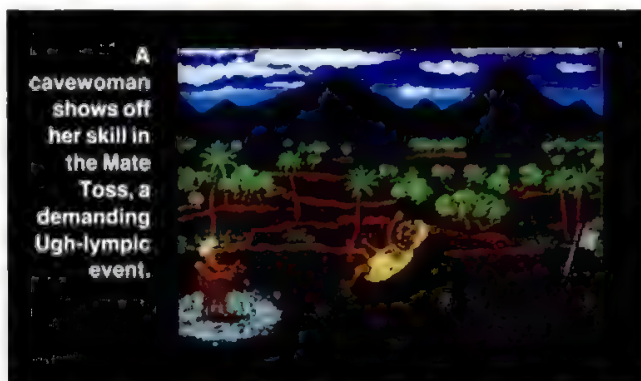
The graphics and animation are original, crisp, and appropriate to the Neanderthal age. My only criticism is that the action is so fast and furious, joysticks easily lose their calibration; the game needs a pop-up calibration routine. *The Caveman Ugh-lympics* ranks with *California Games* and *Tetris* as a computer-game classic. ■

List Price: *The Caveman Ugh-lympics*, \$29.95.

Requires: 512K RAM, graphics adapter, DOS 2.11 or later. Joystick recommended.

Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404; (800) 245-4525.

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*	Dataease International	221	153	NEC Home Electronics Inc.	24-25	200	Xerox	211
504/104	Datastorm Technologies	292	508	Network PC	350	518	Xyquest	80
*	Dataworld	228-229	*	Northgate Computer Systems	300-301	732	Zenith Data Systems	108
278	DCA	189	*	Northgate Computer Systems	320-321	269	Zeos	30-31
536	Dell Computer Products	C5-C8	*	Northgate Computer Systems	285	388	Zeos	29
532	Dell Computer Products	246-249	*	Northgate Computer Systems	282-283	721	Zeos	70-71
527	Dell Computer Products	243	*	Northgate Computer Systems	284	*	Zeos	165-172
256	Delta Technology	122	*	Northgate Computer Systems	281	145	Zeos	254-255
522	Digital Products	92	*	Northgate Computer Systems	286	115	Zeos	173
255	DNA	343	127	Norton-Lambert	127	210	Zoom Telephonics Inc.	264
212	Dolch Computers	81	362	OCR Systems	268			
298	DP-Tek, Inc.	269	*	Oracle	9			
347	Dustin Discount Software	14	241	Pacific Data Products	175			
330	Dynamic Microprocessor Associates	65	297	Pacific Data Products	244			
185	Eicon	4						

* -No Reader Service #. Please call advertiser for information.

-Regional Advertisement.

by
Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

YOU CAN NEVER BE TOO THIN, TOO RICH, OR HAVE TOO MANY BITS
"Nintendo's new Game Boy, a calculator-sized portable black-and-white video game, is probably the hottest video game gift this year. But what serious video-game players are talking about now is '16-bit' game system technology that offers stunningly improved graphics. (A 'bit' is a computer term referring to the sophistication of a computer chip; the higher the number, the smarter the chip.)"
—Tuscon (Arizona) Citizen, December 5, 1989

THE DATA STOPS HERE! (AT 300 FEET)

...and what's more, you'll suffer no problems with data integrity. In fact, this very ad (below) was typeset with the printer "extention" kit.
(Jade Computer stores newspaper flier.)



**In a Year When
Julio Iglesias,
Muhammed Ali,
Princess Stephanie,
and Mikhail Baryshnikov
Brought Out Fragrances,
Why Not an Eau de Big Blue?**

"IBM PC cologne & IBM XT with Epson wide carriage printers and amber monitors, 1 Computer stand.
Entire package \$1200 obo.

xxx-xxxx; xxx-xxxx."

—Classified ad,
St. Petersburg (Fla.) Times,
December 26, 1989

Not Only Do Many PCs Have 100-300 MB Hard Disks, But We Hear Reports of 20,000-40,000 MB Floppies

"The NeXT Computer System is the first computer in the world (and so far the only) to use read/write/erasable optical storage. While PCs today are typically equipped with Winchester drives that store 20 to 40 MB, a single optical disk can store 256 MB."

—NeXT Inc. advertisement

ALTHOUGH A CRASH COURSE IN KILO VS. MEGA (AND WHEN TO OMIT 000) WOULDN'T HURT

"Although you don't need a degree in computer science to make the most of desktop publishing, a little understanding goes a long way in buying a system, evaluating software, and learning how to use the DTP tools you have. Don't let the jargon fool you, or get to you..."

"Floppy Disks: Each 5 1/4" or 3 1/2" diskette can hold hundreds of pages worth of information; most floppy disks hold about 400,000 bytes (a byte is just a measure of computer memory space) while an internal hard disk might contain 20,000 or 40,000 megabytes."

—Dynamic Graphics Clip Bits, May 1989

The 803xx Chip Was Hands-Down Choice for the Mac

"The (Next) CPU, a 25MHz Motorola 68030, was chosen for its powerful features. (Jobs and his engineers might just as well have used the 80386, which has very similar features, but most of the Next crew came out of the Mac world and knew both the 803xx chip and the UNIX applications written for it like the backs of their hands.)"
—PC World, January 1990

...or select the correct spelling using your of **phonetic** (closely spelled) words that appear on your screen. For added convenience, the phonetic list is prioritized from most probable to least probable spelling alternatives. Goodbye embarrassing typos!

Too bad that *VP to the Max*, the \$199 Ventura Publisher utility set from Aristocad Inc., doesn't include a grammar checker ("lease probable spelling alternatives") with its spell checker. Too bad the company didn't use the spell checker on this advertising brochure ("taylored").

CUSTOM DICTIONARIES
Add up to 100 custom dictionaries of your own with *VP to the MAX*. These user-defined dictionaries can be taylored to fit your specific applications, such as occupational vocabularies, technical publications, financial documents, or dictionaries.

Receive a PC Magazine T-shirt and \$50 if we use your submission in *Abort, Retry, Fail?* Winners this issue: Jeff Brandon (printer extention kit), Adam J. Stegner (Mac World), Bill Steele (NeXT), Roger Westrate (Nintendo), Harold H. Delk (PC cologne), Sharon Dahl (VP to the Max), Mark T. Rittgers (20,000 megabyte hard disk).

THE COMPUTER THAT RULES THE WORLD.



The 386 computer rated number one by computer publications in Germany, Hungary, Italy, Japan, Poland, Spain, United Kingdom, United States and Yugoslavia is the same computer rated number one for overall customer satisfaction by corporate volume buyers in America. The Dell System 325.

800-284-1190

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For Dell in Canada, call 800-387-5752.



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*Germany**Hungary**Yugoslavia**Poland**Japan**United Kingdom**Spain**Italy*

When computer publications from nine countries got together and voted for the best 386™ computer, it marked a major shift in power.

They chose the Dell System® 325 head and shoulders over every other system in the world. Turn the page and find out why.

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